Lincoln University Digital Dissertation

Agroforestry
- New Landuse
- New Landscapes

Submitted in partial fulfilment
of the requirements
for
Diploma of Landscape Architecture
Lincoln College
University of Canterbury

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1984

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ACKNOWLEDGEMENTS:

With the writing of this Dissertation I owe a great deal to others who have helped with advice, information or the use of their time or resources.

Special thanks to those in the Landscape Department, Lincoln College; especially my tutor Simon Swaffield for his helpful criticism and encouragement.

I thank Ross Whiteside, Ken Harris and Patrick Milne for their time and interest, Peter Kirk and Shirley Parsons for their generous support and Garth for his patience and transport.

Forward-

The following study examines the landscape implications of Agroforestry as an alternative landuse for farmers in Hawkes Bay. Research management options, technically and economically proven, are examined in relation to Woodstock, a commercial "Forest-Farm". The implemention of the different options available for Woodstock, will have visual implications. These will be predicted, compared and evaluated. The design limitations and opportunities can therefore be recognised, so that future development of Agroforestry will be able to:

- meet the different needs and values of the regions "small grower" and its community
- create logical, harmoniously integrated production landscapes.

Introduction

A new alternative landuse, developed, and proven technically and economically feasible will create changes to the landscape. If the new landuse is widely accepted there will be widespread landscape changes - NEW LANDSCAPES

As a landuse, Agroforestry is relatively new in New Zealand. It can be defined as farming and forestry activities consciously combined vertically and/or temporally on the same piece of land. The development of this concept has been the result of changes within both the farming and forestry sectors.

Over the last decade the Agroforestry concept has been developed through the investigation and implementation of the "Forest-Farm" system, by a team of scientists, from the New Zealand Forest Research Institute and Ministry of Agriculture and Fisheries. This Forest-Farm system, has alternative management options which involve the integration primarily of Pinus radiata, pasture, sheep and cattle.

Woodstock, a joint Lands and Survey and New Zealand Forest Service project is being developed to investigate and demonstrate the Forest-Farm concept, as a commercial enterprise within Hawkes Bay.

As a demonstration Agroforestry landscape, Woodstock will become a significant visual resource, expressing change in the fundamental landuse - landform relationship. Landmanagers, and the general community will respond to this change in accordance to their different needs and values.

The Landscape Architect's role is to predict, compare and evaluate visual implications before implementation. There should be no excuse for unanticipated, illogical and incompatible surprises. There should be no reason for the different needs and values of the regions "small grower", and community not to be satisfied.

If the researched Agroforestry options available have limitations in fitting in requirements of both the site and people, then other options within the system will need to be investigated. Design opportunities need to be recognised within the Agroforestry system, so its management will produce a logical, harmoniously integrated landscape.

Definition

DEFINITION

There are many definitions of Agroforestry.

A useful definition is that of King, which the Commonwealth Agricultural Bureaux have chosen to follow.

King describes Agroforestry as a generic term, covering systems in which farming and forestry activities are consciously combined, (i.e. both components are actively managed) vertically and/or temporally on the same piece of land.

There are three general systems under Agroforestry:

1. Agrisilviculture - in which the farming component involved agricultural crops.

2. Silvopastoral systems where the farming component involves animals grazing pasture. Terms used for this system in New Zealand are varied e.g. "Forest-Farming", "Farm Forestry", "Integrated Farm and Forestry", "Two-tier Farming".

3. Agrisilvopastoral systems (and other three-tier systems) which combine all three systems.

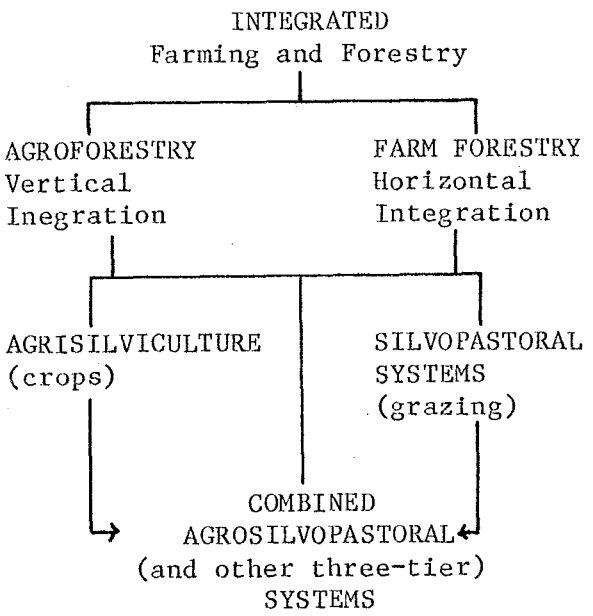


Diagram 1: Systems under Agroforestry

By this definition Farm Forestry is not Agroforestry although it has been often used as a synonym in New Zealand. Farm Forestry covers sytems in which farming and forestry practices are integrated horizontally within a land holding, but not generally on the same piece of land. This includes for example farm woodlots, shelterbelts, plantations and the combined separate land used for agriculture. To confine the objectives, farm forestry is mostly outside the scope of this study.

Agroforestry is a flexible concept which can be orientated to satisfy the

particular requirements of the farmer or the forester, and therefore can cover a wide spectrum of combinations of agriculture and forestry.

Because research in New Zealand has concentrated on the integration of Pinus radiata and pasture, and with the view that the New Zealand rural landscape is still predominantly pastoral, this study will concentrate on the Silvopastoral System i.e. the "Forest-Farm" system.

Reference:

Agroforestry
Annotated Bibliography No 24
Commonwealth Agricultural Bureaux, 1982

Agroforestry

- A New Landuse

A1 THE NEW ZEALAND "FOREST-FARM" CONCEPT

The vertical integration of trees and pasture; the integrated "Forest-Farm" Agroforestry system, is where the land manager has control over both the trees and grazing animals on the same unit of land.

The trees are managed for optimum profitability by producing high quality timber while at the same time pasture utilisation is maximised. Being an integrated system, success depends on both critically-timed, high quality silvicultural regime and good stock husbandry. Most current research in New Zealand is on this system, concentrating on Pinus radiata, sheep and cattle.

A2 WHY AGROFORESTRY?

For the greater part, the New Zealand rural landscape is a consequence of the interplay of farming and forestry culture, and their relationship to the underlying landform.

"Traditionally the planning, design and execution for farming and forestry in New Zealand has been governed by economic (and technical) considerations. That these functions have been to the eye imperfectly done, does not deny their doing or their motivation".

Kevin O'Conner, 1977.

2.1 FARMING TRENDS

Since colonisation, the farming sector gradually grew to become the backbone of New Zealand's economy and social structure. The wilderness was won over. Forests, scrub, swamps and tussocks were converted into a monoculture of rotationally controlled pasture. Pastoralism over the years became to dominate New Zealand's developed rural landscape, its major function was to supply meat, wood, dairy products to a demanding European market half a world away.

Economic Pressures

However over the recent years, the Agricultural sector has suffered major economic hardships. The European market no longer demands meat and dairy products. The external costs of farm inputs, transport and processing have increased dramatically, terms of exchange has dropped considerably (diagram 2) and rural investment has been drained by the "Think Big" projects.

SHEEPFARMERS TERMS OF EXCHANGE AT FARM GATE

SMPs cannot compensate the farmer forever. The answer is for the farmer to diversity and to be flexible for a changing world market.

The farmer therefore needs to be flexible in his outputs from pastoralism, or change from pastoralism to another landuse. Timber trees offer a diversification. They can offer a change in landuse as plantations, woodlots or as an additional output in the pastoral system, hense the new Agroforestry concept.

Environmental Pressures

Farmers over the years have been realising the benefits of trees for environmental protection and control, i.e. shade, shelter, soil and water conservation. However, it has only been in recent years that farmers are becoming more widely aware of the full benefits of greater land utilisation and the economic stability of timbers as a diversified long term income.

Every hill couuntry farm, where terrain varies has areas where efficient and profitable traditional pastoralism is dubious due to adverse environmental conditions. This is where multiple use systems, such as the dual system Agroforestry, will mostlikely be developed if suitable.

In the Tuki Tuki Valley, Hawkes Bay, the environmental conditions of dissected hill country, with areas of low moisture, fertility and phosphate response, together with the economic situation of low production prices expected, made large proportions of farmland unprofitable under the sheep and cattle system. However, Pinus radiata, which has the ability to establish itself in this dry climate, together with opportunity grazing, show a positive return on this land.

Photo: John Aitkens property
Tuki Tuki Valley, Hawkes Bay

"*The quality of social contact and community cohesion obtained seems to depend on the scale and nature of the agencies undertaking afforestation.*"

J.D.M. Fairgray
McDermott Associates

Social Pressures

Individual Expression: Farm forestry has been often practised for values other than just economic and environmental. Timber trees have been planted for social and aesthetic motivations, as an expression of the individual and the farming culture, a statement which is to be enjoyed by the generations ahead.

Family-Based Forestry: New Zealand lacks the tradition of sustainable family-based forestry which is found in other parts of the world such as Europe and Scandinavia (J.M. & F. Aitken). However, there is evidence that this socio-economic tradition, of reaping the crop of your past generation, and planting again for the generations ahead, is beginning on some farms in New Zealand. John Aitken's property Hawkes Bay, is an example of this, where phased forestry planting on large proportions of the family farm, will provide a continuous forest income for generations ahead.

Local Control and Identity: Large scale forestry to the farming community has long been seen as a threat. Owen Smith, 1981, President of the New Zealand Farm Forestry Association explains this threat as a tendancy to associate forestry with "vast areas of forest of a single species, which is claimed to be aesthetically monotonous and biologically unstable".

In the Central North Island Planning Study (CNIPS), of afforestation directions in Hawkes Bay, field experience susggests that the accepted attitude towards forestry is fear. There is no question that farmers' attitudes reflect a fear of reduction of their local power base, as forest companies buy up land around them. A fear of reduction of control and local community self-determination if the pre-eminence of the owner-occupier control and community is lost. There is a fear of being swamped by a "blanket" of afforestation and losing their site identity - their sense of "place" associated in the landscape they live and work in.

However, if future afforestation patterns were to be small in scale, varied, aesthetically pleasing and in the control of the "small grower" i.e. the farmer, these fears would decrease.

The small scale forestry pattern could easily be the trend for afforestation in Hawkes Bay and in other hill country farming reigons. The CNIPS report on Hawkes Bay emphasises the potential for this trend, and for integration of forestry on farms i.e. Agroforestry.

2.2 FORESTRY TRENDS

Exotic forestry as a landuse has expanded rapidly over the last sixty years. The impetus was Mackintosh Ellis 1920's, who planned the afforestation of faster growing exotics to provide a sustainable yield for the future. By the late 1960's, forestry was making money and became a big issue for regional development.

As a cheap resource material, the State sold cheaply to investors and now the Forest Sector is half in State and half in private companies.

Table 1 Present Exotic Forest Ownership

State forests	56%
Public companies	26%
Private companies	8%
Private individuals	5%
Local authorities	3%
Formal groups/societies	2%

FROM: The New Zealand Forest Owners Association. Wise Landuse: Forestry and the Small Grower.

The future looks bright for forestry in New Zealand. With the dwindling resource of world forest reserves, future demand for New Zealand's high quality, well tended timber should continue to rise. Pinus radiata is still expected to be a sought after commodity over the next twenty years (and beyond) (NZFOA).

New Zealand is disadvantaged by distance from certain markets but that is offset by:

- a near perfect climate for fast tree growth
- generally well tended conditions of established forests with judious pruning and thinning which will keep options open for final use.

Afforestation Directions

Traditional afforestation planting patterns in Hawkes Bay have been "determined by land availability and price, which in turn reflect the presence or otherwise of farming, with less emphasis on the physical potential of the land to grow trees. The result has been a tendancy to push forestry to remote, steep, and low productivity country, particulary for State Forests. The problem with such a pattern of afforestation is that it is not consistent with industry efficiency"

(CNIPS study).

A development strategy presented at the 1981 New Zealand Forestry Conference was to increase the forestry resource by 1.3 million hectares, by the end of the decade. This would involve the afforestation of 194,000 ha of new land.

A progressive increase in production forest planting by the small grower was one of the industry's immediate development strategies.

Hawkes Bay has the target of 51,000 ha of exotic forestry by the mid 1990's.

The New Zealand Forest Service and the forest industry generally are concerned that that land suitable for forestry is becoming a scarce resource. Distance from the mill, and port, topography and access, ease of silvicultural and extractional practices, and land with a site fertility and index to grow the larger clearwood logs, are becoming vital considerations for land purchasing.

These considerations will affect the future afforestation patterns in Hawkes Bay and other traditional patoral farming regions. With the realisation that most of the considered suitable land is locked up in pastoral holdings, there is a move to persuade farmers "the small grower" to make the land, less valuable for farming, available for forestry.

This afforestation objective has been backed by Government. Financial incentives are in the form of forestry encouragement grants, with production grants and protection/production grants, with 45% to 66% subsidy of initial establishment costs, and silviculture. This will be paid, without limitation on area or species, to any forest grower who holds a verifiable interest, including farmers, societies and boards, local authorities and companies.

The Government has also approved the joint venture proposed for forestry in the Forestry Rights Registration Act 1983. This agreement is between two parties to grow and share the returns of a forest. The landowner provides the land, the investor provides the funds and expertise. An example of this is the Groom joint venture model involved with farms in the Tuki Tuki Valley, developed as a financing and marketing mechanism.

Understandably, the forestry industry as a whole, is interested in Agroforestry, as a means of getting trees, primarily Pinus radiata, on to more favourable land. Moves for research in this field therefore are probably political. However, with the shift towards low density clearwood forestry and now that research has proven the Forest-Farm concept to be technically and economically feasible,

this landuse is likely to be developed and become part of the production landscape.

The CNIPS study results suggest "that the most appropriate strategy for continuing afforestation in Hawkes Bay is unlikely to be one of doubling the area of large-scale forests. Rather, a mix of selective large-scale forests in some hill country, presumably not beyond the margins of existing forests and within limits which reflect social and environmental criteria, and greater integration of forestry with farming on some of the better pastoral land close to urban areas, is more likely to meet regional as well as national and industry criteria".

Such "Future forest development in Hawkes Bay will have different economic, social, environmental, transport and physical impacts than previously ... the implications of these developments will transcend the individual concerns of government departments and individual firms, landowners and forest workers, rural and urban local authorities.

The future forest development and its implications will be expressed by the visual landscape, which is the concern of the Landscape Architect.

2.3 SUMMARY

Agrofroestry is an alternative landuse for foresters and farmers, and is a means of getting:

(1) Accessible forestry on more suitable land i.e. hill country farms near mills and ports.
(2) Diversification for long term farm income and better land utilisation.
(3) Initiate a tradition of sustainable family-based forestry.

The rural New Zealand landscape will be influenced by the discussed political, economic/environmental and social pressures and motivations for change. With these emerges the "small grower" and the interest of Agroforestry as an alternative landuse.

With this the scale of forestry will be changed from large state and company owned forestry, to the small scale of the small grower, still part of the local farming community.

The implications of this change, expressed by the visual landscape, is the concern of the Landscape Architect.

"Above all, the Hawke's Bay Case Study has highlighted the need for a regionally sensitive view of afforestation. This provides the opportunity for regions to pursue forest sector development directions which accommodate the interests of their own communities and the nation without compromising the efficiency of the sector."

J.D.M. Fairgray
McDermott Associates

"Most environmental issues raised by afforestation relating to water, soil and landscape values, are capable of being resolved by attention to an practice of known management techniques."

J.D.M. Fairgray
McDermott Associates

A3 RATIONALE FOR INTEGRATED FOREST-FARM SYSTEMS

The concept of livestock grazing in the forest is not new in New Zealand. Cattle grazing in indigenous forest has long been an aspect of hill country farming, while grazing in mature exotic forest has been common since the turn of the century, particularly in the South Island.

However, what is new has been a comparatively recent development of designed forest management regimes which incorporate grazing as an integral component. E.H. Bunn (1973) describes the rationale for the integration. At the FRI, Rotorua, the impetus for research was triggered by a series of profitability studies which clearly showed that the most profitable regime for radiata pine was to maximise the growth of pruned trial crop trees by freeing them from competition early in the rotation, therefore early thinnings. Pruned stands managed in this way are sufficiently open to maintain a grass sward, so it was a logical next step to examine the prospects of obtaining intermediate returns from grazing (with its side benefits of better access, simpler stand management and reduced fire risk).

The object of introducing grass or maintaining an existing sward led to further refinements in the silvicultural regime, in adopting wider spacing to fatter, higher quality trees, reducing the number of trees planted, earlier removal of culls, timely pruning of fewer trees, and directions for reducing shade and slash.

This development pattern of a forest regime has been modified and adapted to accommodate farming. The initial impetus in research has come from the forestry sector. Forest companies who acquired grassland for planting were amongst the first proponents of the concept.

Individual farmers soon appreciated the concept's possible application on farms as a means of diversifying production and income without having to write off existing capital improvements. In this case, it means some modification or adaptation of farm management to accommodate forestry. To optimise the combined production, livestock and timber, in profit and substainability, has been a major objective for research in this field.

Reference:

BUNN E.H. "Rationale for Integrating Forestry with Farming"
Paper for: New Zealand Farm Forestry Conference, Rotorua 1973.

A4 RESEARCH

Interest and research over the last decade has been widespread, with the involvement of the New Zealand Forest Service, the FRI, Department of Lands and Survey, DSIR (Ruakura), Maori Affairs Department, Farm Forestry Association, Tree Crops Association, private companies and individuals e.g. farmers.

The FRI have centred much research on the Agroforestry system; to compare the system with traditional farming and forestry systems, to investigate and develop management alternatives, and then to give guidance in the implementation of such management in forest - farming projects e.g. Woodstock.

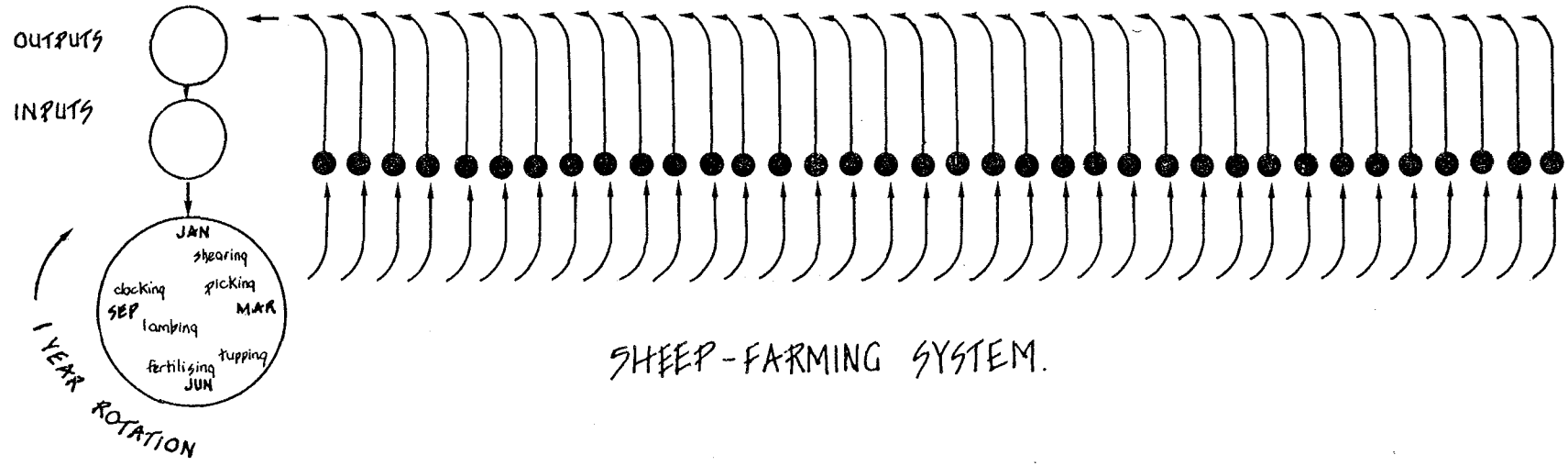
FRI TIKITERE

The 100 ha Tikitere forest-farming research area near Rotorua was established in 1973 as a joint project by the Ministry of Agriculture and Fisheries and FRI. The object of the project was to provide basic information on just how interaction of trees and animals alters the performance of both by comparisons with straight forestry and pastoralism.

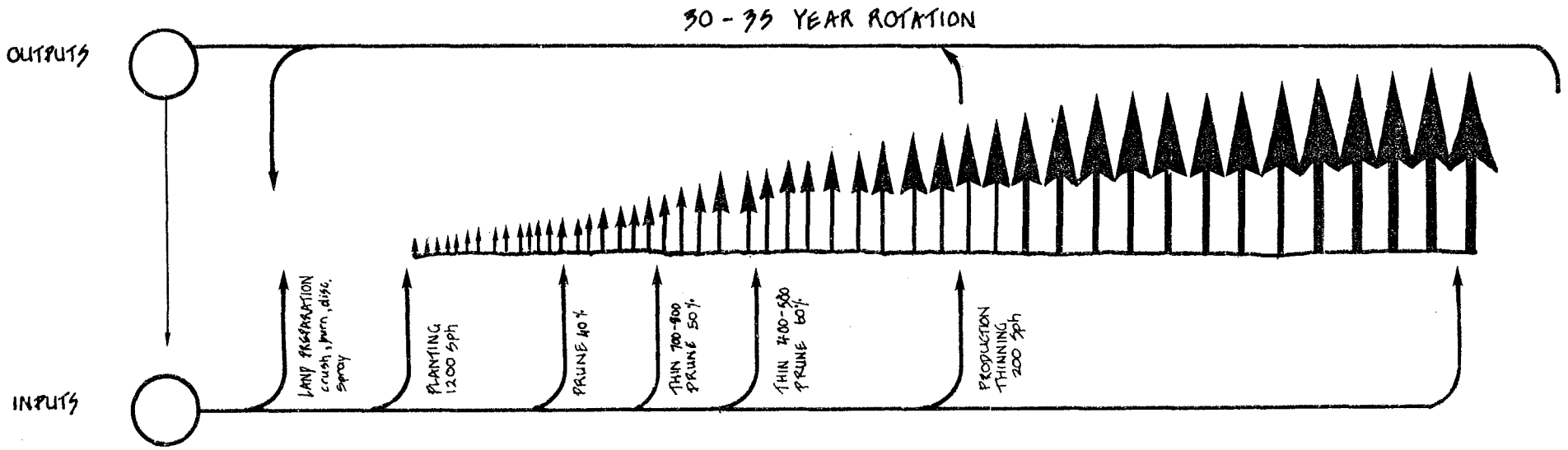
The researched forest-farm system, concentrating on Pinus radiata, pasture and sheep, compares temporally and spatially with the traditional forestry and pastoral systems.

The following diagrams intend to demonstrate these comparisons.

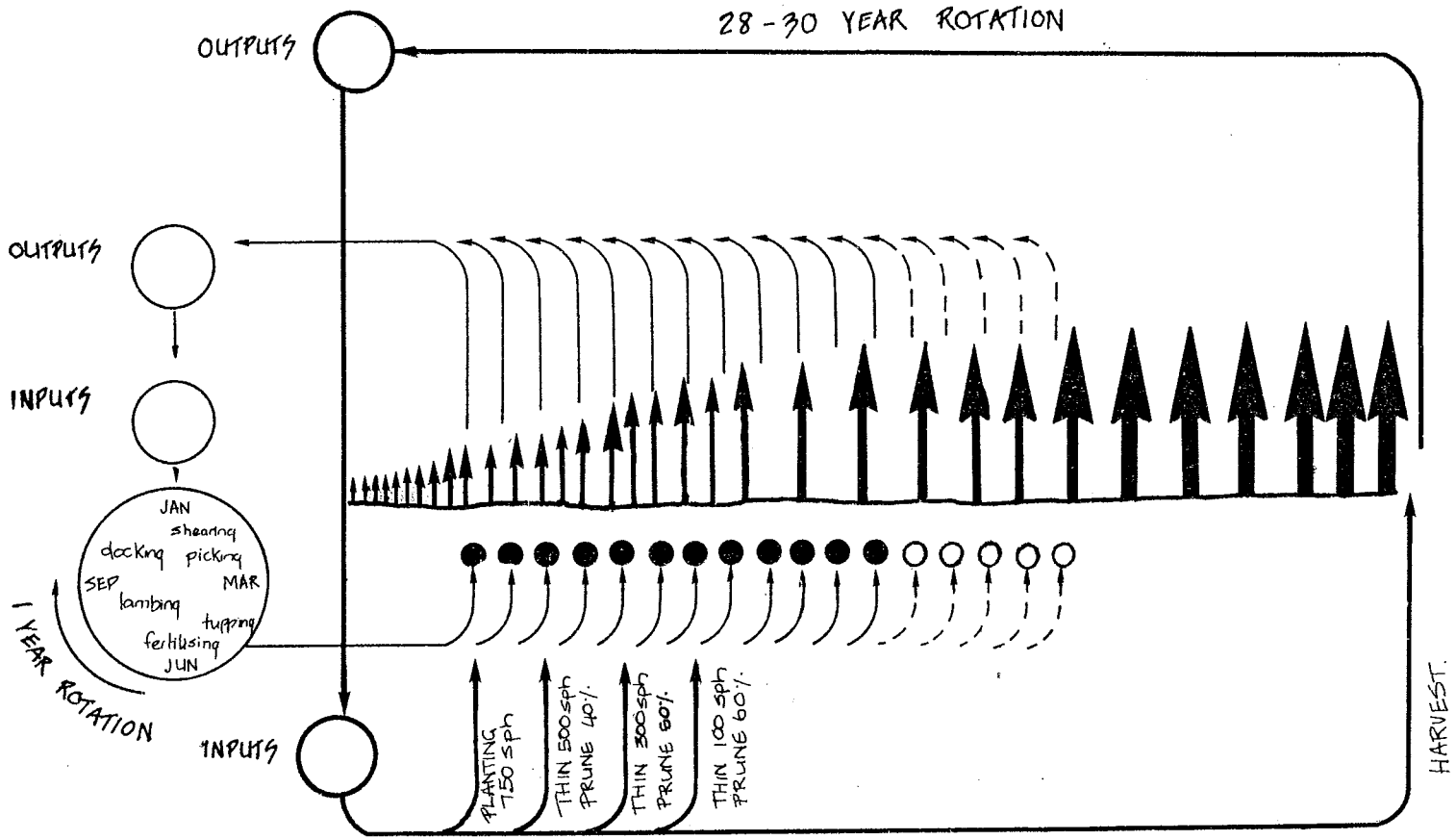
TEMPORAL COMPARISONS



SHEEP-FARMING SYSTEM.



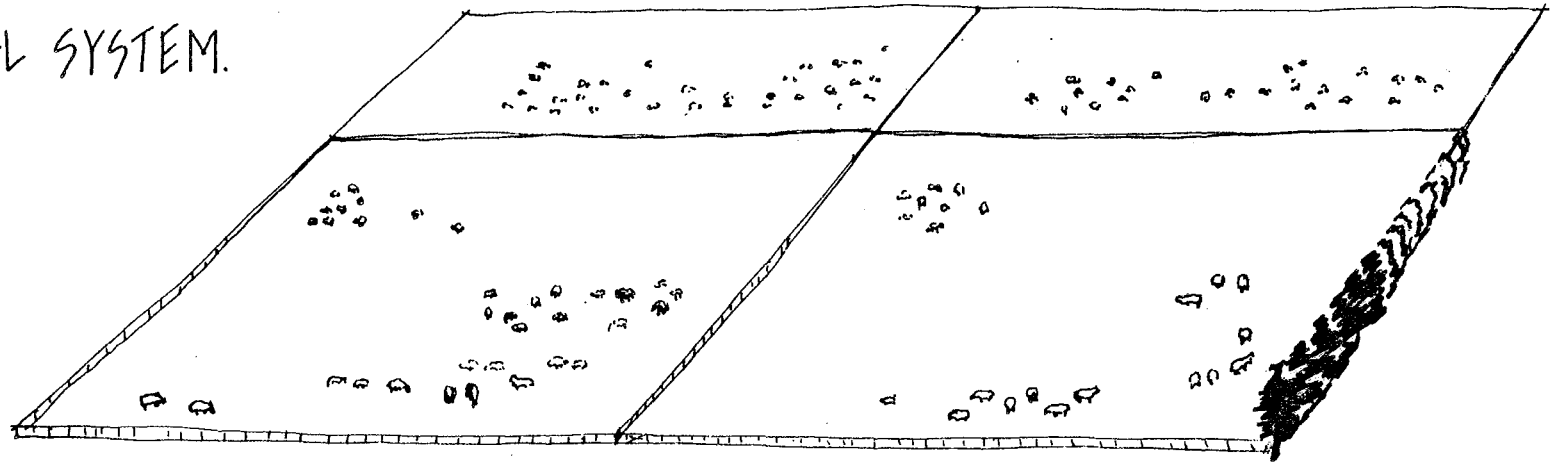
PINUS RADIATA FORESTRY SYSTEM.

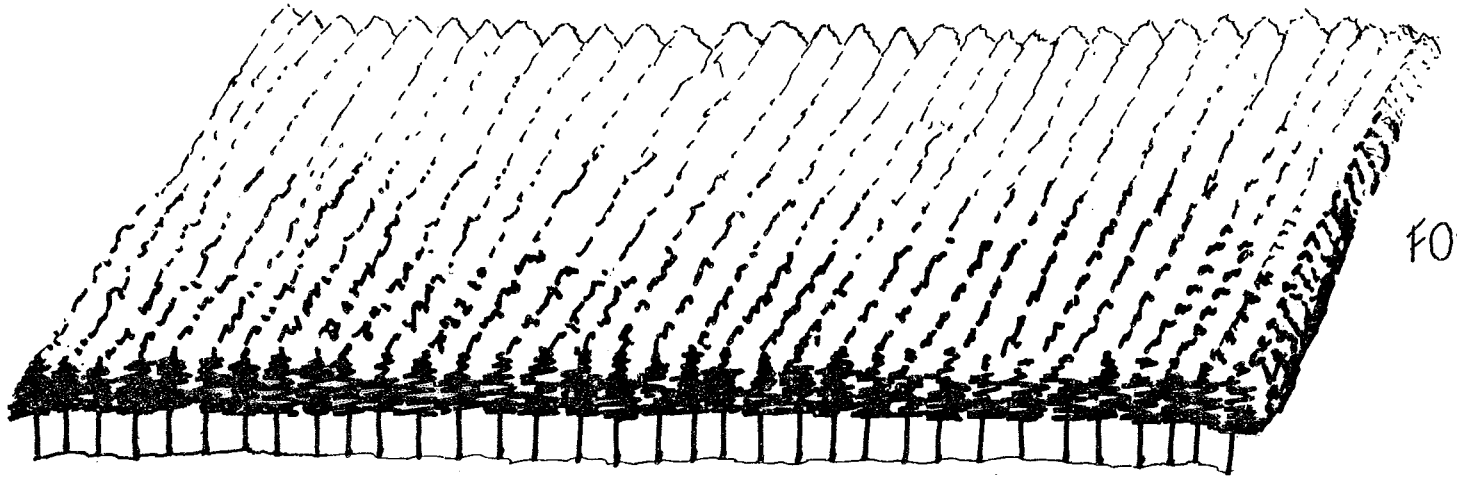


THE FOREST-FARM SYSTEM
(PINUS RADIATA / SHEEP).

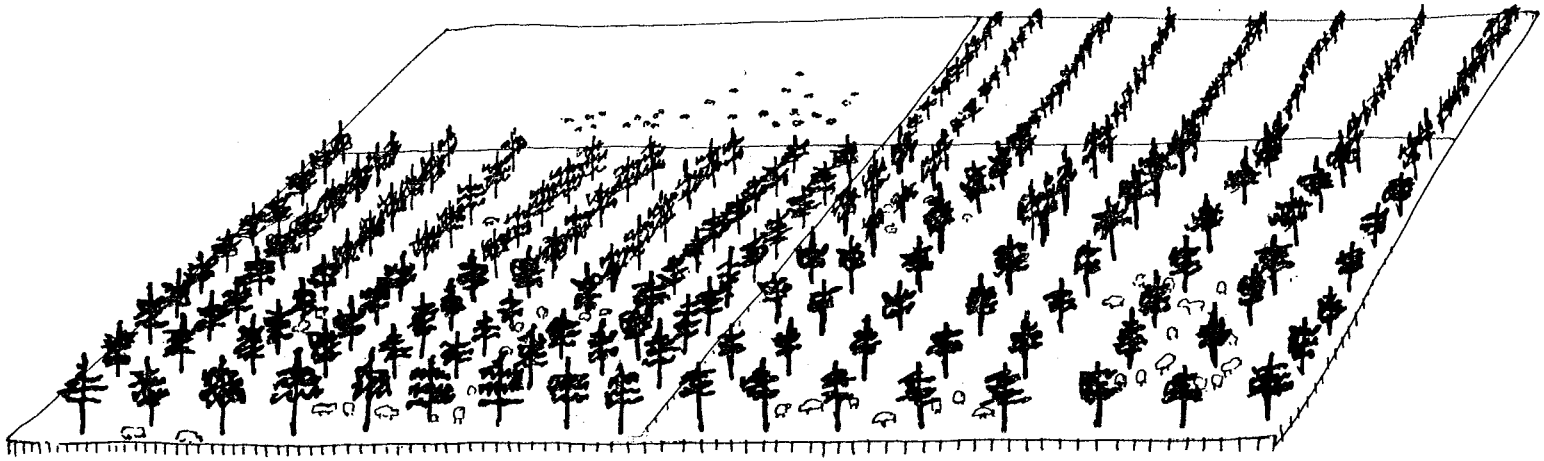
SPATIAL COMPARISONS

PASTORAL SYSTEM.

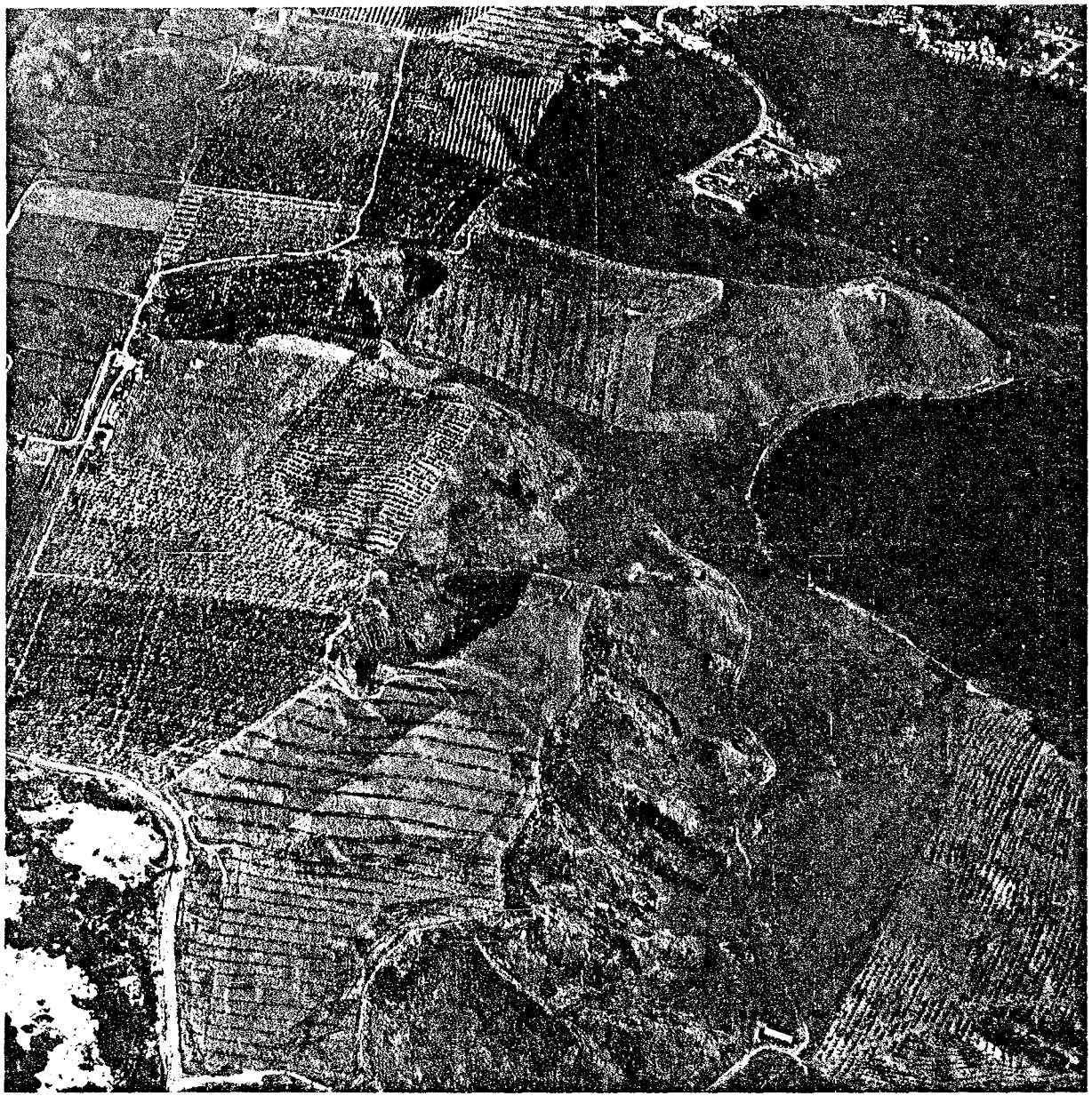




FORESTRY SYSTEM.



FOREST-FARM SYSTEM.



Tikitere "Forest Farming" Research Area.
Source: Fri Rotorua 18232.

Table 2: Arrangement of trees on the Tikitere trail

Final crop trees stocking stems/ha	Initial Spacing (m) between rows	between trees	Average Final Spacing (m)
Open pasture	-	-	-
50	14.2	2.8	14x14
100	7.1	2.8	10x10
100T^2	3.51	1.4	28x5
200	7.1	1.4	7x7
400	3.5	1.4	5x5

T^2= Two rows 3.5 apart and 24.8 m gap to the next two rows

Source: NZFS Handbook 1983

Photo: Tikitere 1978

Source: FRI Rotorua SS22356

Management Trial

Pinus radiata were planted at five different densities for thinning down to 50, 100 (wide spaced and twin rows), 200 and 400 stem/ha, with clear areas as pasture control. (see table 2). Each treatment was planted at five times final crop density to provide sufficient selection.

Early management - first 4 years emphasis was given to tree establishment with little grazing.

Trees were pruned to 6 m in 4-5 lifts. Cull trees were thinned to waste at each pruning.

Pasture legumes which are shade tolerant, and electric fence technology for controlling stock, are new developments in agroforestry management techniques.

Summary of Major Findings

- Successful integration of farming and forestry require clear objectives and a high standard of management.
- Trees grow faster on farmland than comparable forest sites.
- A higher standard of silviculture is essential to produce high value sawlogs with a vigilant and timely approach.
- Slash and tree competition are the major effects on agricultural production in the first ten years, after that it is the effects of shading. These effects depend on density of trees.
- Livestock performance is little affected by trees up to 100 stems/ha. Above 200 stems/ha livestock performance declines.

At medium prune
Final crop 50 stems per ha
Source FRI Rotorua SS27337

Table 3: Recommended pruning schedule

	Low prune	Medium Prune	High prune
Average tree height	5.5 m	8 m	10.5 m
Recommended pruning height (% of total height)	40	50	60
Expected range in heights	4-8 m	6-10 m	8-12 m
Range in pruned heights (Length of stem pruned)	1.6-4 m	3-6 m	4-6 m
Approximate tree stocking	Twice final crop	1½ times final crop	Final crop

Source: Tikitere Handbook 1983

The Silmod Model - R.L. Knowles (FRI) and N.S. Percival (MAF)

Since 1980, work for measuring and analysing alternative forestry practices has proceeded on a new approach using a computer-based simulation model called SILMOD. This simulates the growth of a Pinus radiata, only species simulated at present, stand given almost any combination of silvicultural treatment, site, or rotation age. The model predicts yields and log qualities, and then harvesting, transport and sawing costs.

SILMOD not only provides projections of unconventionally treated young stands, but also allows projections for silvicultural treatments, sites, rotations and processing combinations for which there are no actual examples. In short, SILMOD lets us ask any number of "what if" questions.

Early results from the agroforestry trails at Tikitere were used in combination with SILMOD to provide a preliminary evaluation of the potential of agroforestry.

Major Conclusions of SILMOD

It is clear that each situation produces a unique result in terms of forestry and agricultural production, and over-all profitability, and that a modelling approach appears to be the best method if identifying the most profitable combinations of agriculture and forestry.

Factors Having a Major Effect on the Result Are

Site location: distance from mill, accessibility.

Site Index: factors such as soil depth, rainfall, altitude, exposure aspect and latitude which can be used to predict the tree height growth potential.

Fertility level: the influence of site fertility on basal area. Pastoral areas represent "high" levels of fertility. (However, areas with fertility too high will reduce quality in the density of the timber).

Finalcrop stocking: the most profitable agroforestry systems tested involved final crop stockings of about 100 stems /ha with four-lift pruning carried out on an annual basis.

Rotation length: depends on site factors, but probably average around 30 years.

Farming gross margins: comparison in farming alternatives, which is the difference between costs and returns, personal drawings or new development. Farmer also has to consider effects on cash flow, taxation, estate planning and labour requirements for his particular situation.

4.2 FRI, RANGIORA

Milne and Franklin, FRI, suggest Agroforestry on the Canterbury Plains can be profitable if trees can be grown for timber and also provide useful shelter.

The usual way to do this is to plant trees as shelterbelts - "The Ideal Agroforestry Layout" is as follows:

Recommendations (Milne and Franklin)

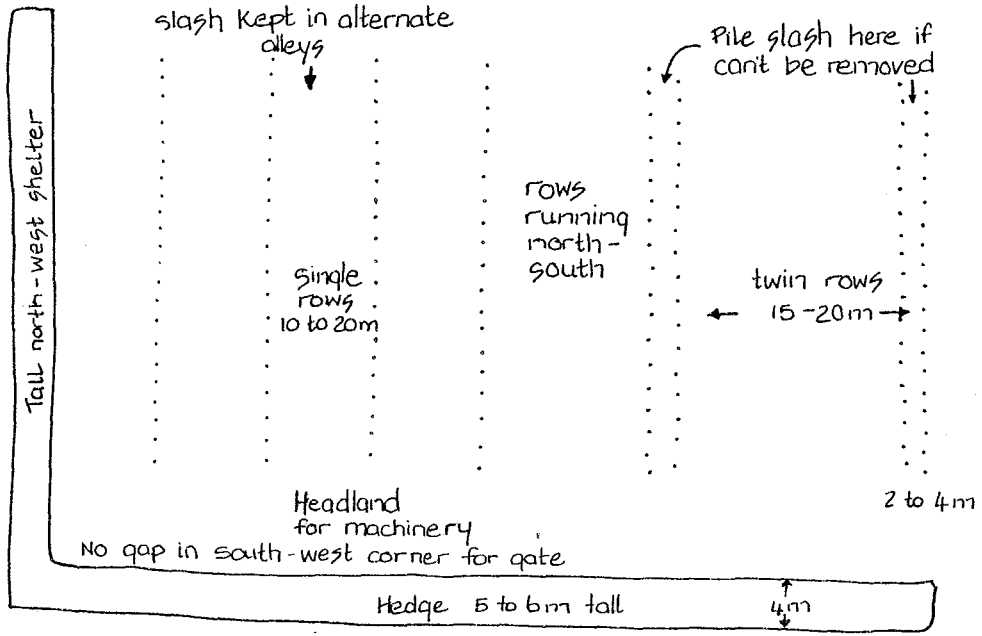
Only trees if producing high quality logs should be grown. The best final crop stocking is probably between 80 and 100 stems /ha. To complete with pasture only retain logs capable of producing high quality butt logs. Thus, between the ages of 4 and 7, a good maxim is "when in doubt, chop it out".

To maintain maximum pasture production and minimise slash: all unwanted trees should be removed as soon as they can be identified.

The number of seedlings planted should be minimised. Work has been done in propagation with cuttings and improvement of nursery stock. To ensure high survival rate of seedlings, good soil preparation, with ripping is highly recommended.

Investigations have begun with other species: Cuppressus and Eucalyptus.

THE IDEAL FORESTRY LAYOUT.



SOURCE : FRANKLIN + MILNE, "AGROFORESTRY ON THE CANTERBURY PLAINS."

4.3 FRI HAUTAPU, TAUPO

Here there has been extensive trials with a wide range of group planting arrangements with pine and pine-eucalyptus mixtures. These are mostly set out at 8 m and 10 m centres. They compose of spacings; squares of four trees, 1.2 apart; triangles ditto, and rows of five at closer in group spacings.

The best tree in the group will be favoured and early thinnings done. Such group plantings allow for easy access and plenty of light for good grazing. (Neil Barr)

References:

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"Space Message for Australasian Foresters"
N.Z. Farmer, December 22, 1983

FRANKLIN D. and MILNE, P
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37(2): 203-7 (1976)

N.Z. Forest Service Handbook 1983
"Forest Farming Research at Tikitere"

Okuku Pass, North Canterbury

A5 IMPLEMENTATION

The New Zealand Forest Research Institute have been guiding the New Zealand Forest Service and Lands and Survey in the implementation of "Forest farming" projects. The objectives for these projects are to investigate, develop and demonstrate the "forest-farm"concept as a commercial enterprise within a particular region.

Three major projects are:

(a) Otago Coast Forest - a large scale New Zealand Forest Service operation since 1974.

(b) Okuku Pass, North Canterbury - a joint project of Department of Lands and Survey and N.Z. Forest Service since 1974.

(c) Woodstock, Hawkes Bay - the first block to be proposed. However due to managerial problems this project has taken until recently to get off the ground. A management plan was approved in June 1983.

In the section following, Woodstock will be examined as a case study.

Woodstock

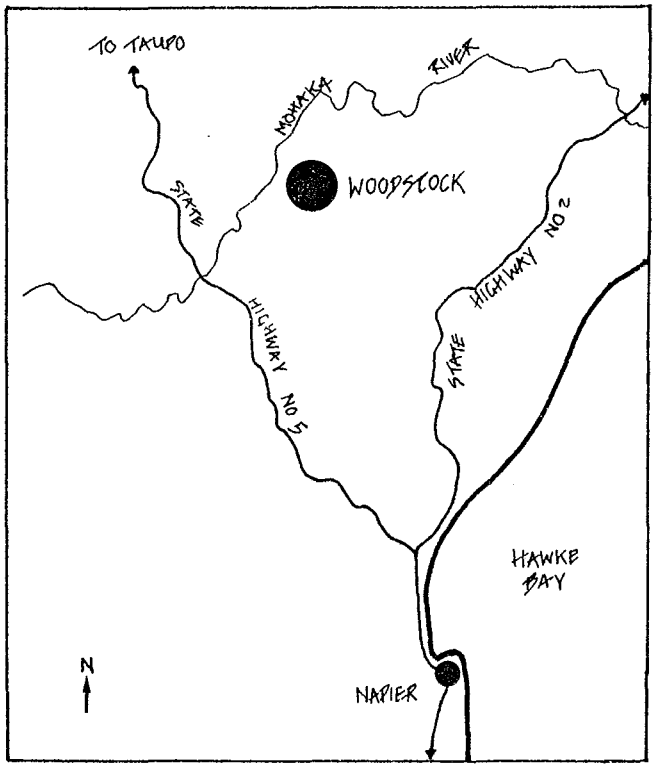
– A New Landscape

B1: WOODSTOCK:
A DEMONSTRATION FOREST-FARM
PROJECT

1.1 GENERAL DESCRIPTION

1.1.1 LOCATION

Woodstock is located inland Hawkes Bay - 6 km northwest of Napier, off the Napier-Taupo Highway.



Map 1: the location of Woodstock
S.S. Strand

1.1.2 BACKGROUND

Woodstock was initially in large block of 6705 ha of unoccupied Crown land, which was destined, along with neighbouring land development blocks, for farm development by the Department of Lands and Survey. However a 1969 Land Use Committee report recommended that approximately half the block be developed into farms and the balance to be afforested by the New Zealand Forest Service. Between 1970 and 1973 the two Departments carried out developments along these lines, but in 1973 a proposal was put forward for them to develop the entire block jointly.

In 1974 the proposal to the Minister of Lands and the Minister of Forests for one: the approval to establish Woodstock as an integrated forest-farm venture, and two: for acceptance of the scheme in principal for other areas in New Zealand, was approved and signed.

Reference:

S.S. STRAND "Woodstock an Integrated Farm-Forestry Management Project"
NZJF Vol 21 No 1 1976.

1.1.4 MANAGEMENT PLAN

A management plan was approved in June 1982. Planting regimes before the 1981 plantings have been haphazard due to managerial problems. So Woodstock has alot of potential for future investigation, development and demonstration of different management techniques within the Forest-farm system.

The main objectives under the 1982 Management Plan are:

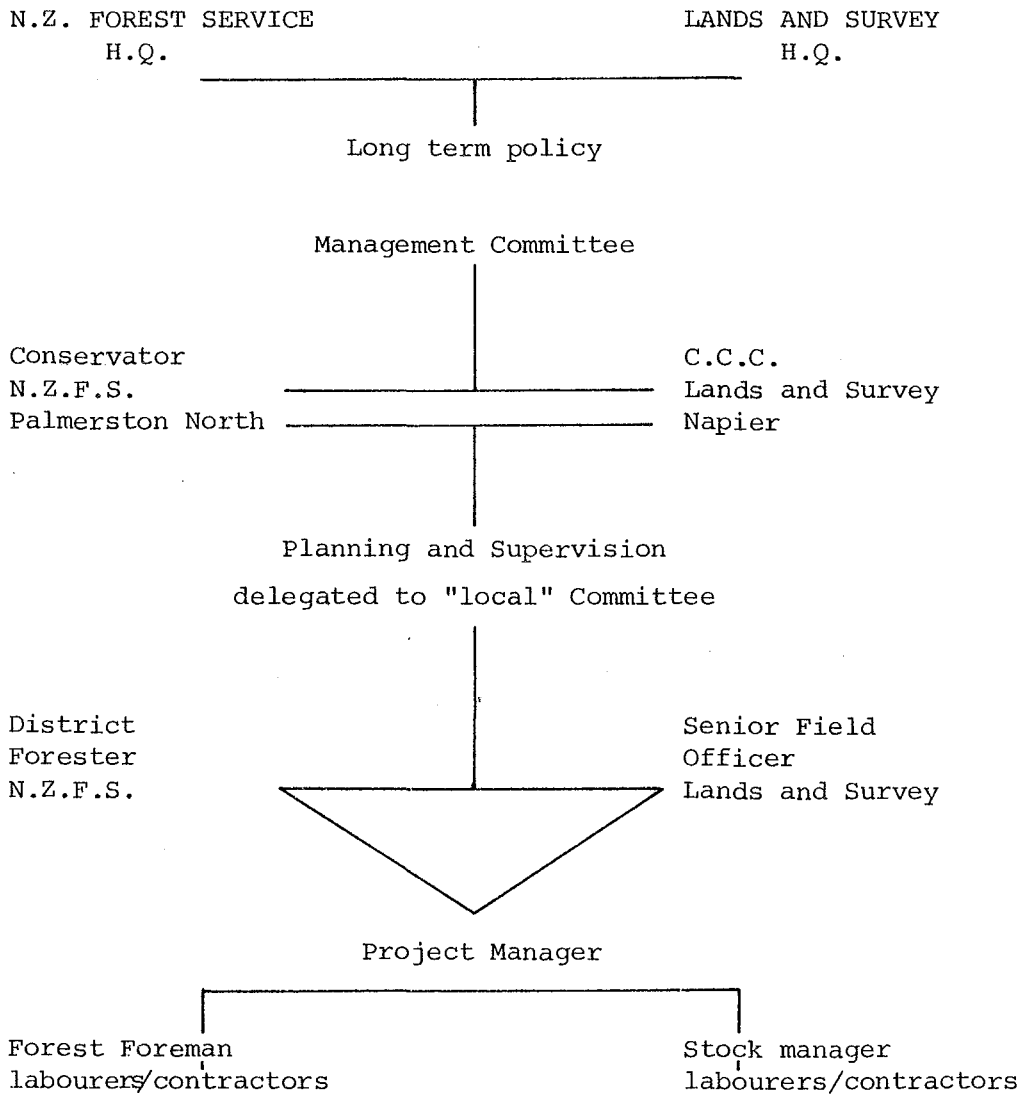
- The "Forest-Farm" is to be managed to achieve the most effective integration of forest and farming.

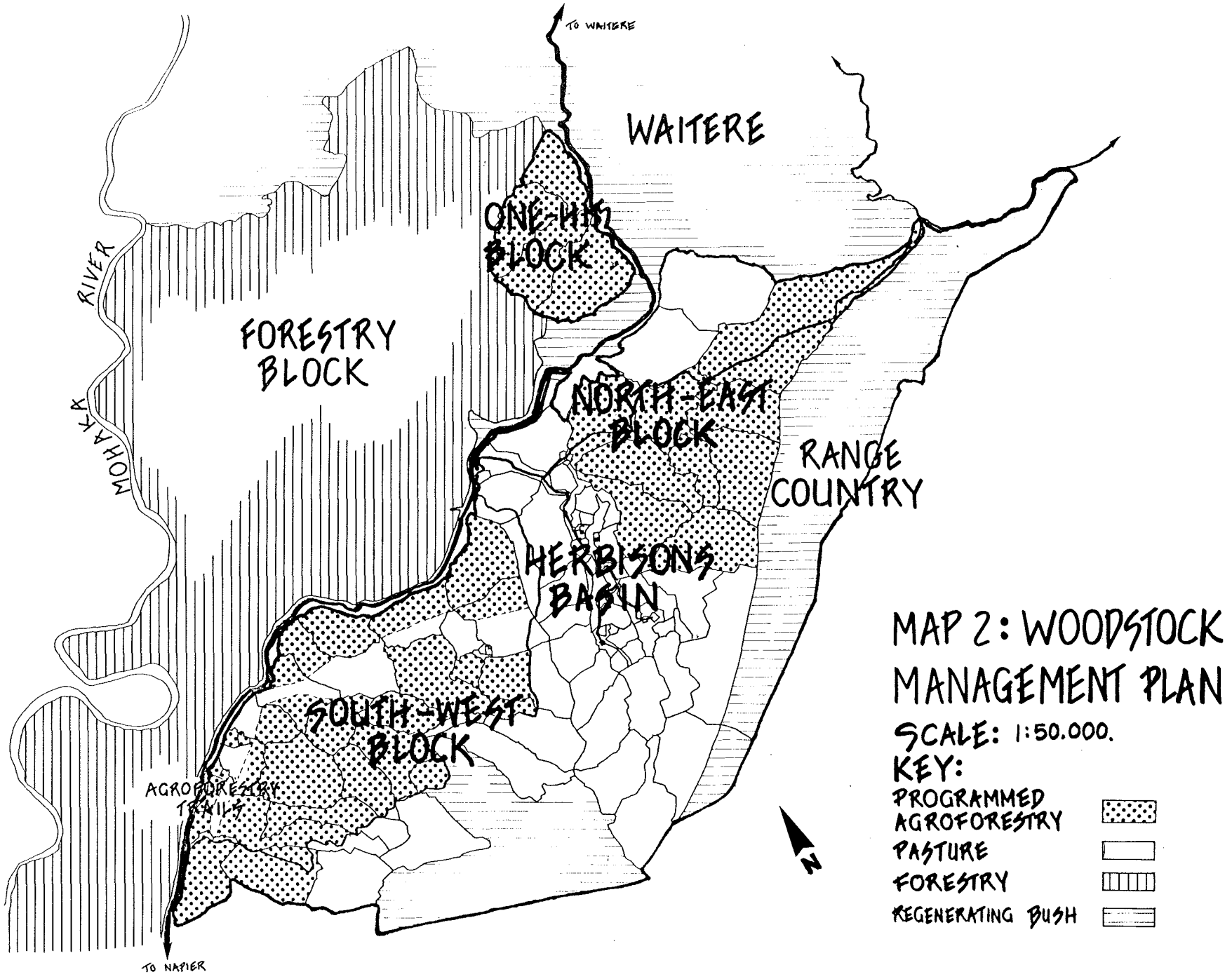
- To investigate, develop and demonstrate the "Forest-farm" concept. However within the constraints, management will optimise profitability and production of meat, wood and wood in an integrated fashion from the project area without compromising land use practices.

- The project is to be managed as a commercial venture, not as an experimental project, although there will be some emphasis given to the development of new management techniques, and on the demonstration of the practice of forest farming.

- "Failure is as important as success"
Anonymous

1.1.3 THE WOODSTOCK MANAGEMENT ORGANISATION




TO WAITERE
WAITERE
ONE-HIS BLOCK
FORESTRY BLOCK
RIVER
MOHAKA
NORTH-EAST BLOCK
RANGE COUNTRY
HERBISONS BASIN
SOUTH-WEST BLOCK
AGROFORESTRY TRIALS
TO NAPIER
N
MAP 2: WOODSTOCK MANAGEMENT PLAN
SCALE: 1:50.000.
KEY:
PROGRAMMED AGROFORESTRY
PASTURE
FORESTRY
REGENERATING BUSH

References:

STRAND S.S.
Woodstock An Integrated Farm/Forestry Management Project
NZ Journal of Forestry Vol 21 No I

Department of Lands and Survey, NZ Forest Service
1982 Woodstock Management Plan

1.2 THE SIGNIFICANCE OF THE WOODSTOCK LANDSCAPE

The Woodstock landscape is presently characterised by dissected rugged pastoral hill country lying between the extensive and dominating Maungaharuru Range and the dense forestry clad hills bordering the Mohaka River.

WHY IS WOODSTOCK IMPORTANT

Woodstock is a lived-in and worked-in landscape for the isolated few who manage the land. It is also a driveu-through landscape, by those who use the river for recreation and therefore a concept for Woodstock as part of a visual corridor to the river.

However, what is particularly important, is that the Woodstock landscape is a demonstration landscape - an expression of man's manipulation to the environment intended to investigate and develop the integrated forest-farm concept.

How people perceive the Woodstock environment would be based on their association with it. To take this further in D.W. Meinig's essay "The Beholding Eye Ten versions of the same scene" we confront with the problem "any landscape is composed not only of what lies before our eyes but what lies within our heads".

1.2.1 AGROFORESTRY LANDSCAPE AS A SYSTEM

Meinig saw that scientists, with their desire to understand and explore their world in a scientific approach, would view the landscape as a "system". A group of FRI scientists are engaged in exploring the Agroforestry system concentrating on Pinus radiata, pasture, sheep and cattle.

The design of the Agroforestry system therefore would be based on the research of processes, inputs and outputs, intereactions and networks. The components and processes are evaluated, with objectives of maximising and sustaining productivity. Systems are analysed and compared, options chosen and developed. The landscape is an expression of experimentation of the system and its management upon the land.

Photo: Tikitere
Source FRI Rorotua SS 31714

1.2.2 AGROFORESTRY LANDSCAPE AS AN " ARTIFACT"

The options which maximise and sustain production within the system, chosen as appropriate to the Woodstock environmental conditions are then developed and managed, as a commercial demonstration Forest-Farm.

The emphasis is on a management recipe to optimise profitability and production of meat, wool and timber in an integrated fashion.

The landscape becomes viewed as an Artifact (Meinig). The landscape expresses what man has created, altered and manipulated in his environment. The potential demonstration landscape would express the working relationship of the forest-farm; the combination and patterns of integrated development over time and space, working together with the natural elements - landform, drainage, climate and soils.

The Woodstock enterprise is a model for hill country farmers looking for diversification in land use. If Woodstock forest-farm recipe proves commercially viable, land managers -whether they be farmers, boards, socieites, companies or State, would consider the application of this land use elsewhere in Hawkes Bay. This would especially be so in areas of similar physical environment - of rugged broken hill country (not uncharacteristic to Hawkes Bay), of suitable location, proximity to ports, accessibility and site index fertility.

The production system that is ecologically sound will make economic sense. If the ecology of the Forest-farm system fails, the productivity and sustainability will fail, additional costs of inputs will be needed and the project will suffer economically.

The land manager viewing the demonstration landscape as an Artifact, evaluates it according to economic values, cash flows and profit. Because money is easy to measure, and necessary for ensuring a standard of living and wealth, economic values are the easiest and most widely used rationale for the use and management of the land.

1.2.3 AGROFORESTRY LANDSCAPE AS A "HABITAT"

The land manager that is aware of ecological principals will view the landscape as a Habitat (Meinig). He will view himself in a working relationship with nature, adapting and altering in productive ways, not against, but along with nature.

With the rise in awareness of the environment and diminishing, finite resources, land managers are becoming more aware of their role of stewardship of the land.

The scientific and aesthetic values of New Zealand's indigenous vegetation and wildlife is renowned world wide and the nation has a corresponding responsibility for its protection which is mainly done through conservation.

However, ecological values are difficult to quantify and evaluate.

To comprehend the ecological values of a production landscape, such as the demonstration "Forest-farm", the viewer needs to understand what is required for ecological health; for the survival of all processes and species in a stable and sustainable ecological community. The site ecology, the environmental conditions and its relationship with the living community and its sensitivity to change in terms of stability and sustainability are important considerations for the success of a productive system.

"A healthy landscape, in balance within itself and within its surroundings, is likely to look, as well as in the long term, favouring forests and farming through sustained fertility and a healthy ecological environment."

Silvia Crowe

The demonstration "Forest-farm" landscape is not only important in expressing the scientific needs of the scientist, or for the economic and ecological needs of the land manager so to produce food and timber, but also the ethical values, the social and aesthetic needs of people.

The Hawkes Bay countryside is an important resource to both urban and rural population. Woodstock demonstrates possible implications of change to this resource.

"The physical environment does more than provide our physical needs; it is our constant companion."

Anstey and Thompson

1.2.4 AGROFORESTRY LANDSCAPE AS A "PLACE"

Jennifer Roy (1982) suggests "the way we perceive our environment is the basis of our relationship with our surroundings and consequently must be an integral part of our response to the landscape".

People's relationship with the land is influenced on what it affords them, whether it is physical, social, visual or financial. The cultural landscape is an expression of people's attitudes responding to their relationship with the land. The more positive the relationship, the more cherished the land, the greater the sense of "Place".

In the living and working environment of the rural Hawkes Bay communities, the landscape would be viewed as "Places". Meinig describes a "Place" as a "locality where a viewer encompasses all and accepts everything he see, as being some interest". A landscape that "cultivates a sensitivity to detail, to texture, colour, all the nuances of visual relationships, and more, for the environment engages all our senses, the sounds, smells and the ineffable feel of a place as well". The attitude of fear towards large scale forestry is because such monoculture erodes the sense of "Place". As Owen Smith states "it is claimed to be aesthetically monotonous and biologically unstable."

With increasing urbanisation in Hawkes Bay (106,000 people urban) and in New Zealand as a whole, and with the surge for outdoor recreation, more New Zealanders are seeking rural recreation.

There is relatively little reliable data on this matter in New Zealand. However, the detailed study by Ann Neighbour (1973) showed a significant finding that rural-passive recreational activity was the highest appeal among a Christchurch urban-based population sampled. The rural-passive recreation - driving, walking for pleasure, picnicing, is a response to the visual environment. The visual environment, the landscape therefore becomes a significant resourse in its own right. The production systems, Agroforestry or whatever are part of this visual environment, the cultural rural landscape.

1.2.5 AGROFORESTRY AS AN "AESTHETIC" LANDSCAPE

S. Challenger (1974) states that since the urban population is slowly increasing .. "it is obvious that urban demands upon the countryside must be satisfied and contained."

The greatest demand for the rural-passive recreationist whether urban or tourists, would be visual quality. The environment thus could be viewed as Meinig "Aesthetic" landscape, as scenery expressed by colour, texture, line, form - elements which are individualistic and therefore intimately variable. However there are elements which people universally respond to subconsciously, these are coherence/unity/variety and mystery, and in the right balance these collectively constitute visual quality" (Anstey and Thompson).

1.2.6 SUMMARY

The Agroforestry landscape would be one viewed as a "system", an "artifact", a "habitat", a "place", or as as an aesthetic expression.

The Woodstock landscape represents a resource in its own right, as an expression of the fundamental landuse and landform (site ecology) relationship.

Demonstrating the Agroforestry system to Hawkes Bay, Woodstock will be important to scientists, fulfilling their technical requirements, to the land manager, with economic and environmental needs, and to the community as a whole. Agroforestry, if feasible to the "small grower" will have social and aesthetic implications to the lived-in, worked-in environment, as well as to the visual resource of rural New Zealand. People will respond to implications in accordance to their different values.

"The visual environment is part of the totality of things, with food and ecology and social concern and appearance as part of the whole brief."

S. Challenger

References:

ANSTEY C. and THOMPSON'S "Creative Forestry"
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CHALLENGER, S. "The Visual Environment in the Rural Zone"
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Vol 8 No. 3, August 1974
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LITTON, BURTON R. "Aesthetic Dimensions of the Landscape"
Ex J.V. Kutilla "Natural Environments"
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Pg 7-9

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Department of Geography, University of Canterbury, 1973

ROY, Jennifer
"Perception of the Environment"
The Landscape October 1982 pg 7-9.

B2: VISUAL IMPLICATIONS

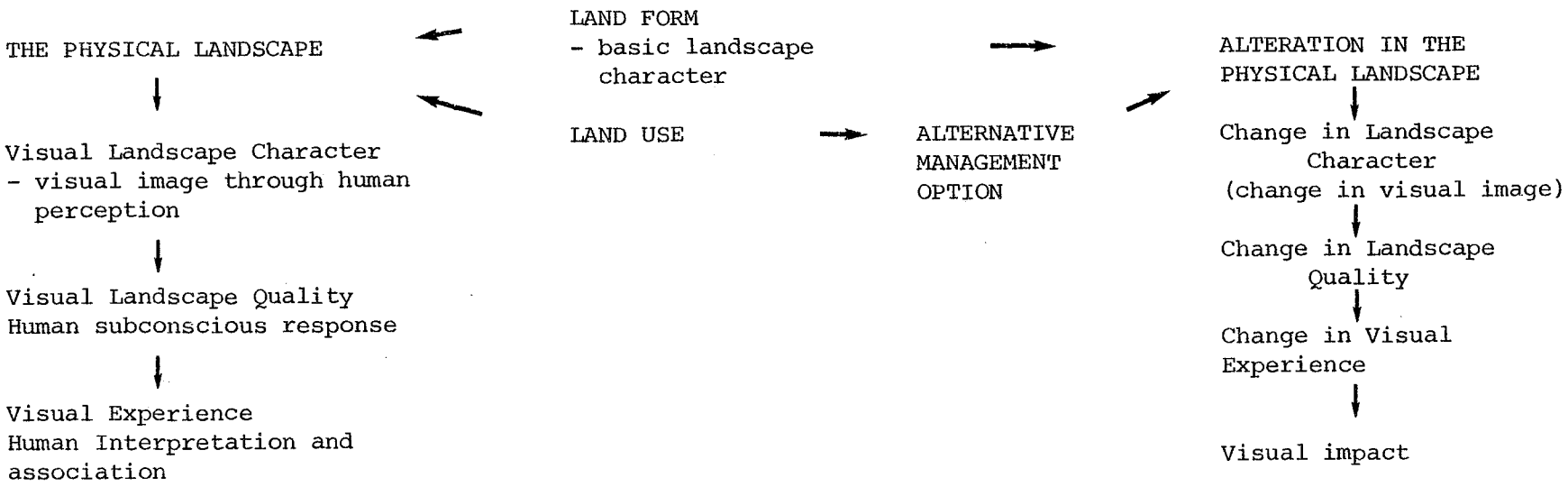
2.1 LANDSCAPE DESCRIPTION

The visual landscape is a means for people to understand their relationship with the land whether it be scientific, economic, environmental, social or aesthetic.

The alternative Agroforestry management options implemented at Woodstock will change the landuse-landform relationship, expressed by the surface cover. This will result in a change in landscape character and visual quality.

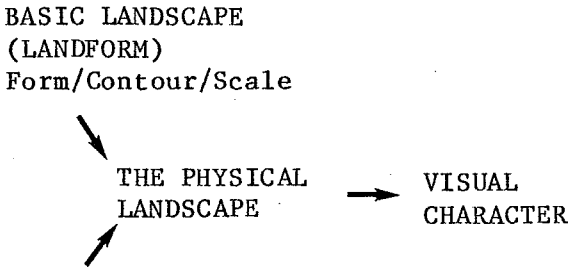
The potential landscape implications should then be predicted, compared and evaluated. There should be no excuse for there being unanticipated, illogical and unfavourable surprises.

When considering the visual implications of any landuse alteration, the landscape designer and manager should first consider the landscape as a whole (a resource expressing the fundamentally different landuse relationships with the land), and then assess the change of visual character and quality as a result of alternative landuse.



"Every landscape has its own character and pattern, its range of tone and colour. This character is based on the facts of geology and climate, and developed through the history of landuse. It is only when this individuality is appreciated, that forestry (or Agroforestry) can be developed into a good landscape altered to its locality."

Silvia Crowe



2.1.1 LANDSCAPE DESCRIPTORS

VISUAL CHARACTER

Woodstock is an expression of the present landuse relationship with the underlying landform, the basic landscape.

S. Challenger (1970) suggested descriptors for visual character of the landscape, are useful here to describe Woodstock as a farm and forestry landscape. These are based upon landform and landuse.

The Basic Landscape

The landform, its contours and its relative scale of variations in relief, is a primary source of visual character. This originates from the geological structure of the area, and the effects of climate, vegetation, drainage upon it over time. This could be called in the widest sense the "site ecology" of an area which gives the landscape its basic underlying character.

The Land Use

The landuse as a response to human need and values is expressed as surface pattern (colour/line/texture) upon the landscape. This pattern alters the visual image of the landform, therefore the way people perceive it as a cultural experience.

VISUAL QUALITY

As designers of the environment we must challenge to discover elements in the landscape that people universally respond to subconsciously.

Elements of Visual Quality

Stephen Kaplan who has studied human perception suggests that these elements are coherence, variety and choice
i.e.
- to allow for a sensible environment
  coherence/order/unit/logic
- the option of novelty
  variety/diversity
- opportunity to choose
  choice/freedom/mystery

C. Anstey and S. Thompson evaluate the quality of the landscape by using the elements unity/variety/mystery and naturalness. Coherence is added here. These elements collectively combined in the right balance gives visual quality.

Unity and Variety are best taken together although they may appear to contradict one another. Variety can only be appreciated in the context of unity. Order is monotonous without variety. Too much variety can be confusing.

Mystery is that which "tantalises - a point where we centre our attention, and concentrate our thought and senses. It is a dimension that draws the viewer in. There can be mystery in moving through an environment, with expectation of sudden views and new perspectives."

Coherence enables an environment to be made sense of to final order, uncovers rules and relationships so the individual can relate to it. To permit choice - is to have freedom within order. As with the expression "naturalness" found in the natural systems.

Natural systems provide us with "unusual quality" with the naturally diverse patterns within a unified cohesive character. Diversity within unity is essential for adaptive potential. Hence if a landscape is ecologically sound, odds are it should look good.

"Our appreciation of landscape beauty is in some way an intuitive response to ecological harmony."

Anstey and Thompson

VISUAL VULNERABILITY

The development of the "Forest-Farm" at Woodstock will alter the existing pastoral surface cover, to that of integrated trees and pasture. The altered landuse/landform relationship is expressed by the visual image, which will determine visual character and quality.

The visual implications of changes in surface cover depends upon the vulnerability of the existing character. The reason for sensitivity or resistance to visual change, is related to the basic landscape, the site ecology. Such areas need to be identified so they can be managed during landuse change.

R. Burton Litton states three sources of visual vulnerability can be identified in any landscapes -

(1) The presence of destructive landscape characteristics: form/scale/line.

(2) Sensitive parts and locations: edge/altitude.

(3) Outside influences and inherent effects: exposure/aspect - topography/slope/soil stability.

2.1.2 PROCESS FOR PREDICTING AND EVALUATING VISUAL IMPLICATIONS

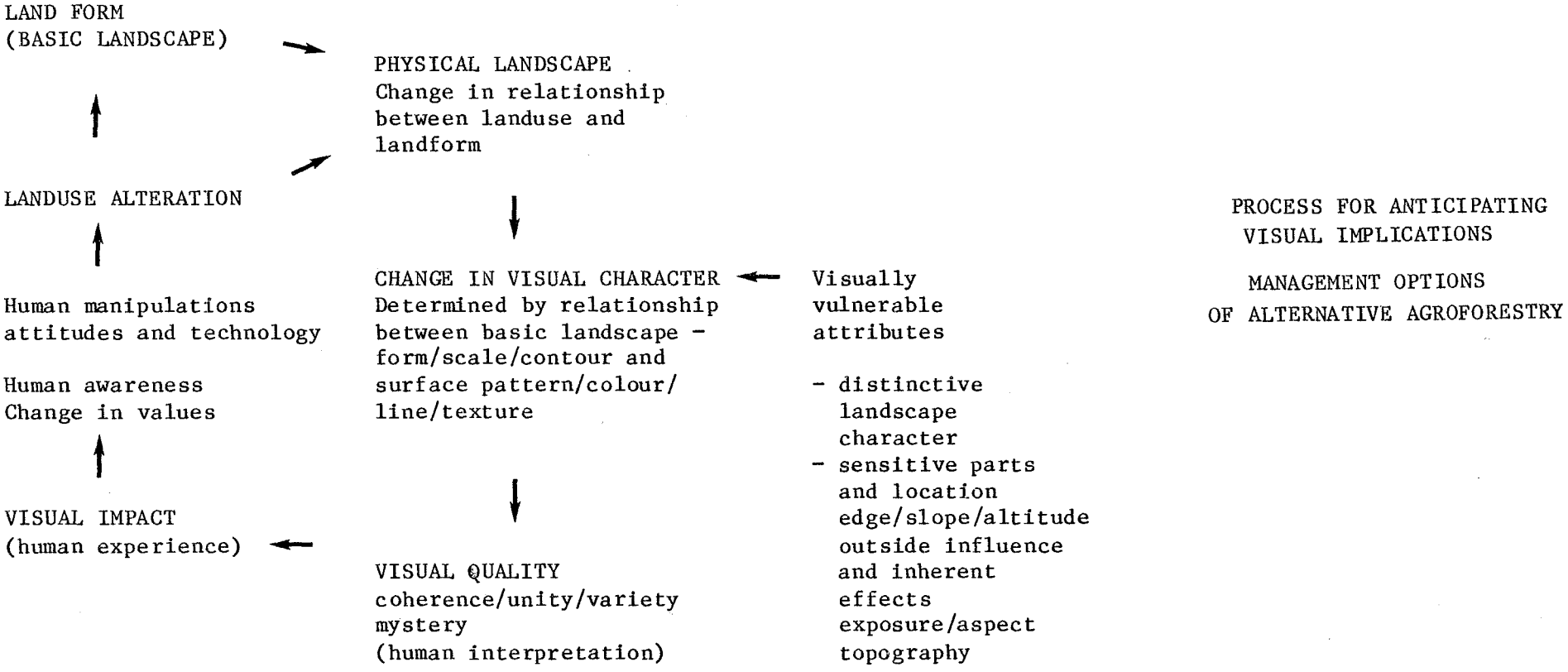
Litton suggests the identification of the visual vulnerable attributes as a method for anticipating, evaluating and managing visual impacts.

The following method will be used to predict and evaluate the visual implications of the alternative "Forest-farm" options available for Woodstock.

1. Observe and document existing landscape character and visual quality, and characteristics that appear visually vulnerable or resistant to impact.

2. Investigate alternative options of silvopastoral management technically proven by research.

3. Finally, develop design criteria to make compatible relationships between management options, people's requirements and the landscape.



2.1.3 EXISTING VISUAL LANDSCAPE DESCRIPTION

To ease the task of describing the existing visual character, quality and identifying visual vulnerable attributes, Woodstock naturally subdivides into geographic areas based on landform, location, present and proposed landuses.

THE HERBISON BASIN

The Basin has been developed as the farming headquarters for the original Woodstock project. Located in the centre of the block.

Herbison Basin is a very distinctive landscape feature. A huge natural armchair with its own microclimate, drainage and vegetation ptterns. The Basin as a spatially enclosed character created by the massive backdrop of the Maungaharuru Range rising 600 m above the foot of the Basin. The wall completely dwarfs the scale of the farm settlement nestled in surrounding hillocks and knolls.

The Basin harbours the base farm, and staff housing. Therefore the area is the most cultural in character, intensively managed with features of farm infrastructure, the farm buildings, yards, roads, woodlots and multipurpose planting.

This lived-in, worked-in environment expresses a more culturally intensive landscape. With the involvement of Landscape Architects of (Lands and Survey) in this area, the landuses have been developed with awareness of the influencing natural characteristic features, namely the native vegetation following the gullies and its unique microclimate.

With 300 ha fully developed to pasture, it is ideally suited to remain as the grassland farming base for the "Forest-farm" project, (1982 Management Plan), therefore its present character is to be retained.

THE RANGE COUNTRY

The area higher than 750 m above sea level totalling 580 m, which is confined to the Maungaharura Range Country.

Woodstock lies on a north west face of the huge Mohaka Valley, and is visually and physically defined by the magnificantly dominating Ranges, steeply rising to a maximum altitude of 1300 m above sea level. The massive limestone bluffs, the exposed mountain vegetation, and the bush tucked into gullies, expressed as surface pattern (colour, texture, line) follows landform, drainage and succession patterns, giving "naturalness" in its visual chracter and quality. The Range's massive scale with their convex, steep slopes, gives Woodstock its "big country character".

As a backdrop to the broader Woodstock landscape, the Maungaharura Range is the most dominant feature, therefore the most visually vulnerable. This is due to its conspicuous mass and height, scale - which drawfs the landscape below and its strong contour distriction of the earth-sky silhouette.

This area has limitations for grazing, providing extensive sheep grazing only during periods of feed shortage, and a habitat for wild goats. The area is considered too high for economic forestry.

Landscape Architects involved in the 1982 Management Plan, have recognised the Range country as an "unique landscape entity" in itself and should not be modified in any way. The surface cover emphasising the landform and its natural patterns therefore will be retained, the landscape character (form, contour and scale) will be unchanged.

SURROUNDING AREAS

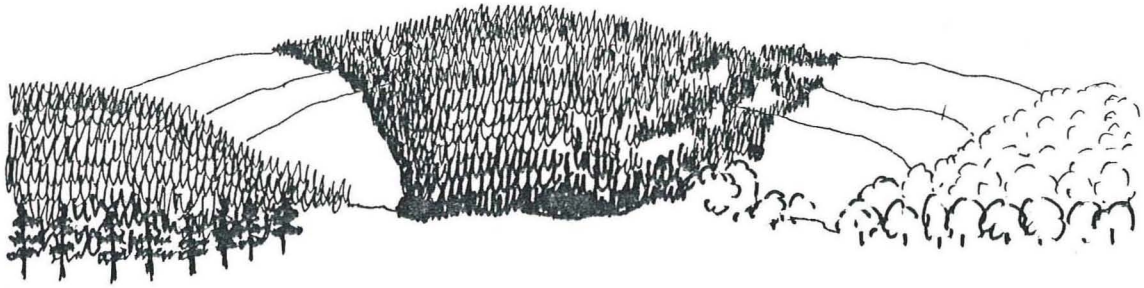
Waitere

To the north, beyond Woodstock is a backdrop of higher bush clad hills. The diverse colours and density of textures express the regeneration of bush communites. The denser and coarser the texture, the softer the hills visually. This cover emphasises natural patterns, giving "naturalness" to the Woodstock backdrop.

This is the last large block of nature regenerating bush in Central Hawkes Bay, the controversial Waitere Lands and Survey block, which has been declared as a kiwi habitat.

Regenerating bush clad hills as backdrop.

Woodstock protection forestry



large scale, simple pattern,
- visual vulnerability

small scale, varied pattern,
- visual absorption

Woodstock Forestry Block

West of the Waitara Road, the landform continues in a dissected pattern of hills and gullies to the river. This land was allocated for protection forestry before the Forest-farm proposal.

The monocultural system of Pinus radiata protection forestry is expressed as a surface cover of a dense course texture which "blankets" the rugged contours and the natural drainage and successional processes. As the contour distinction and scale is lost, the landform becomes less of a feature. The landscape is visually more softer, stable and less distinctive.

The uniform texture, over large areas has unity with little variety. The simple pattern is highly vulnerable to alterations, such as harvesting. If the scale of forestry was reduced in scale, with a variety of shapes, textures, colours, the landscape would be more able to visually absorb alterations.

PROGRAMMED FOREST-FARM AREAS

South West Block

To the south west of Herbison Basin, over the Goldmine Range, the landform slopes steeply down from the Maungaharuru Range into a more complex pattern of numerous hillocks, knolls and gullies, that eventually drop down to the Mohaka River.

The landuse has been semi-intensive pastoral management, rotationally grazed, maintaining a surface cover that has a uniform thin fine texture, which emphasises the naked landform, and its dynamic processes drainage, erosion and succession.

These dissected, naked hills, as a response to pastoralism geology and climate, are characteristic of many parts of Hawkes Bay. Compared with the Maungaharuru Ranges the visual vulnerability of these hills are much lower. The scale, mass and height of the landform is much reduced, becoming more human and acceptable to cultural alteration.

The pattern of relief, the lines and shapes are more complex, which help obscure alterations. However, under pastoralism, because of the uniform, fine pattern of the surface cover, the landform dominates the visual character. If the surface pattern changes, this character is vulnerable to change.

Dissected hill country to be changed from pastoralism to Forest-farming.

The rest of this block is programmed for planting at a latter date with the experiences of the south west block considered for decision-making in future planning.

The "One Hit" Block

North east of Herbisons Basin

North East Block

The area to the north east of Herbison Basin has similar landform and landuse relationship, visual character, quality and vulnerability, as the South West block. The landscape expresses the pastoral system, emphasising the naked dynamic landform, rugged and dissected, as the major landscape feature.

"One Hit Block: Silvopastoral planting has commenced on the 158 ha "one hit" block west of the Waitera Road. "One Hit" being the establishment of pasture and trees at the same time. This alternative landuse compares with pastoralism, expressed by surface pattern, colour, line, texture. The changes in landscape character, and usual quality will need to be predicted and evaluated.

The pastoral surface cover gives unity upon the variety of the dissected landforms, but little coherence in terms of natural vegetation patterns, and little mystery.

This area has been programmed for a staged development of Forest-farm management, with 15 - 20 % of the area left in open pasture for ready access for stock holding and handling. 170 ha has already been planted (see Map 2). The surface pattern is therefore to be changed.

2.1.4 VISUALLY VULNERABLE ATTRIBUTES

SENSITIVE PARTS AND LOCATIONS
- after Litton

Edges/Transitions

Are where dissimilar materials or management come together. These areas are especially vulnerable to disruptions. The more conspicuous a meeting of ingredients, the more vulnerable it is to the impact of change.

The Skyline: The most vulnerable edge is the skylines of any landscape because of the way they display changes. The darker terrain solidity is in sharp contrast to the ligher film colour of the sky or brightness of the clouds. The Maungaharuru Ranges limestone rock formations give a strong edge conrast.

Ridgelines: Separated in space and viewed against more distant land surfaces are a "sometimes thing" because ridgelines may also be skylines depending on location of observer.

Fencelines: Where different management regimes come together are vulnerable.

Altitude

The vulnerability of edges also relates to location. Attention is directed to the maximum contrast where sky and solid meet. The higher the location, the more extensive both the area and distance from which it can be seen.

OUTSIDE INFLUENCES AND INHERENT EFFECTS

The "site ecology" components such as climate, topography, soils, can also modify the appearance to visual impacts. Litton refers to "outside influences" to certain aspects of climate, aspect and seasonal change.

Exposure: Observation of different exposures influence surface colour and patterns, by effect on vegetation such drying westerlies, drought on north-west facing slopes, effecting growth and grazing patterns.

"The landform pattern defines both the vertical and horizontal scale of the landscape. Ridgelines, the transitions between earth and sky, and visually prominant; they are an important feature of cohesion."

Anstey and Thompson

Aspect: Full light exposure or backlighting and shadowing involved with orientation suggest greatest vulnerability for the north, followed by west, east and south. The Ranges facing north-west are therefore high in visibility. The dissected foot hills are more varied in their orientations, decreasing their visual vulnerability.

Topography: Has an inherent effect to visual vulnerability (Litton). The steeper the slope the greater the visual vulnerability. The reasons for this are perceptual as well as one of impact on scale and repair. As we observe steeper slopes rising in front of us, we see increasingly more of the slope surface and what ever it supports.

A typical impact Litton refers to, is road construction which will occupy increasing amounts of transverse area as slope steepens. Thus, the scale of the impact tends to grow and with it, the slope and difficulty in re-establishing vegetation and soil stability. Disturbed soils are usually a lighter tone than undisturbed, creating visual contrast.

Visual vulnerability of roads crossing over dynamic steeper slopes also is influenced by surface cover, the denser more textured the cover the less vulnerable due to the stabilising effect of erosion processes.

2.1.5 **SUMMARY**

Each of the different landuse systems; protection forestry, pastoralism, or extensive grazing, are expressed by surface patterns which each have a different relationship to the basic landscape, therefore determining different visual character and quality.

The programmed Forest-farm system will change the existing pastoral surface pattern. It will change the visual character and quality, and therefore have visual implications.

Vulnerable attributes of the current character are:

- ridgelines
- edges between management regimes i.e. fencelines
- higher altitudes
- exposed, north to north-west facing slopes
- steepness and instability of slope
- roads cutting across the slope.

References:

LITTON R. Burton Jr
Visual Vulnerability of Forest Landscapes
Journal of Forestry
Vol 72, No 7, July 1974

LITTON R. Burton Jr
Aesthetic Dimensions of the Landscape
Ex J.V. Krutilla Natural Environments
Publisher: John Hopkins, 1972

Department of Lands and Survey, and New Zealand Forest Service
1982 Woodstock Management Plan

2.2 RESEARCHED AGROFORESTRY MANAGEMENT OPTIONS AND THE PREDICTION AND EVALUATION OF THEIR VISUAL IMPLICATION

The visual images of different researched management options available for Woodstock are to be predicted and compared in consideration to their relationship with the basic landscape.

The change in usual character and quality is then to be evaluated.

2.2.1 THE AGROFORESTRY MANAGEMENT PLAN AND OPTIONS AVAILABLE FOR WOODSTOCK

The general development plan according to the 1982 management plan is to have 990 ha of the 1880 ha block for Forest-farm production. 240 ha of this has already been planted in Pinus radiata. Most of the 990 ha will be planted, however in the initial stages 15 to 20 % will be left in grass to ensure all compartments have ready access to open areas and the base farm, for the ease of grazing and stock management.

The Planting program is supposed to follow an orderly rotation progressing from west to east with a 25 ha block planted each year. This would mean it should take 25 - 30 years before the phased planting is completed, and with rotational harvesting this would ensure a sustainable crop. Grazing would be done using large mobs of sheep in a short, closely monitored, rotational grazing system after second year of planting, until tree canopy restricts grass production in 15 - 20 years.

This has been the overal plan for the Forest-farm development. However due to past mismanagement, with problems of stock control, development has been haphazard.

So now prior to planting a paddock, fences are upgraded to ensure exclusion of stock and weeds are controlled.

Planting has been at 1500 s/ha at 3.6 x 1.8 m. Initial SILMOD analysis have indicated that final stockings should be reduced from 200 stems/ha to 100 stems/ha. Consequently planting in 1983 was at 800 stems/ha at 7 m x 1.8 m and may be reduced further as silvicultural regimes are firmed up.

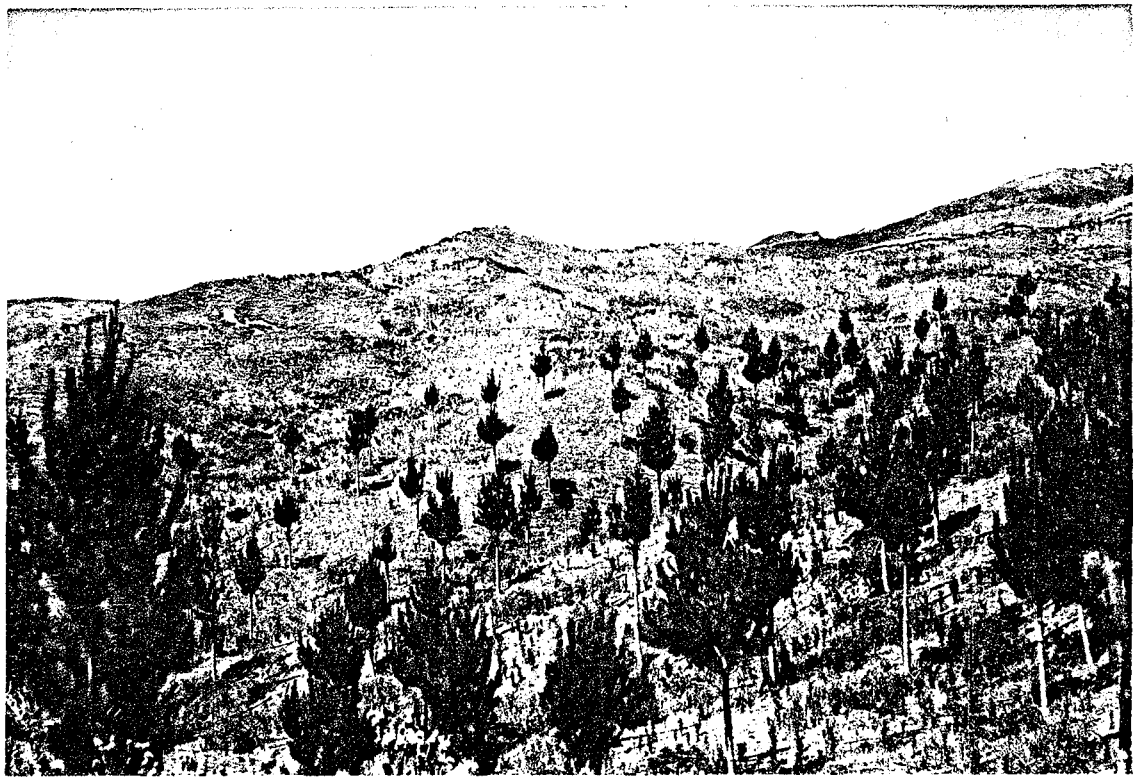
Sivicultural regimes for Pinus radiata are still being tested on SILMOD, and the following regime has been adopted meantime.

Table 4:
1984 Silvicultural Regime
R. Whiteside, Esk Forest

Age	Mean Crop Height	Pruning Height	% Crown Removed	Diameter Over Pruned Stubs	Thin
3	3.0				
4	4.6	2.2	47	13.4	500
5	6.2	3.6	57	13.8	250
6	7.7	4.5	58	14.7	150
7	9.1	5.8	64	16.6	100

Table 4:

1984 Silvicultural Regime R. Whiteside, Esk. Forest



1977 tree spacing trails

The significant features are annual very heavy, early thinnings to reduce slash build up and shading, and annual severe pruning to control defect cores.

Tree spacing trails have been planted since 1977 at 150, 100 (optimum) and 50 stems per ha.

Up to 1983 layout for planting at Woodstock has been in tight rows, 3.6 m apart. With FRI recommendations for rows, the 1983 spacing between rows was increased to 7 m.

With previous research done on 10 - 20 m spaced, wide double rows, square and group planting layouts, trails are now underway at Woodstock to investigate these alternative planting layouts.

2.2.2 PROJECTED VISUAL IMPLICATIONS OF RESEARCHED OPTIONS

The phased planting programme with its recipe for spacing, layout, and silvicultural management, together with the rotational grazing regime, impose a changed surface pattern on to the landform. This results in visual implications.

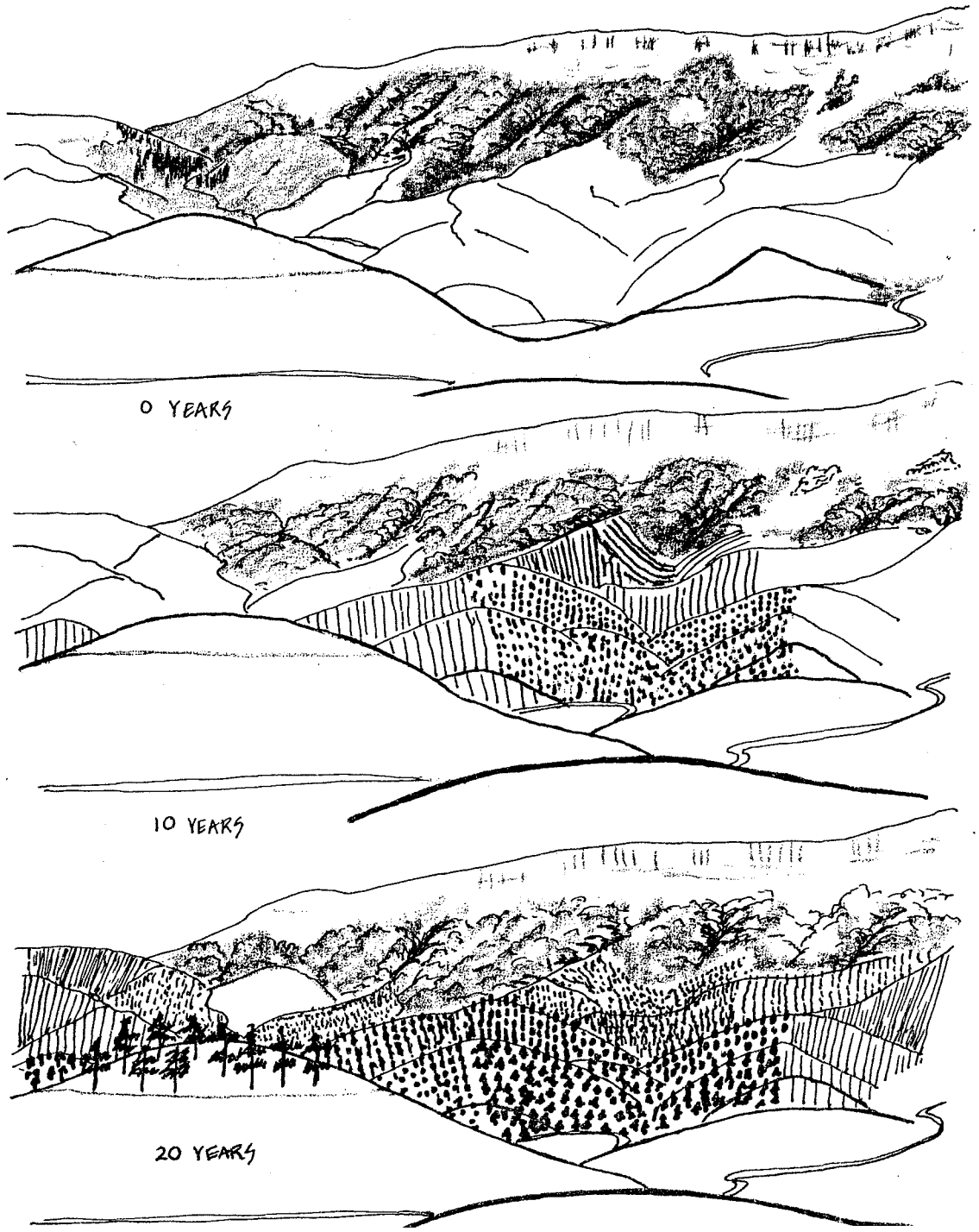
TEMPORAL AND SPACIAL IMPLICATIONS

The surface pattern of integrated trees and pasture under the "Forest-farm" management plan varies -

(1) Over time: Depending on the age of the tree, stage of silviculture and the effects of rotational grazing and the seasons on the pasture.

(2) Over space: As a response to the 25 ha blocks pf phased and varied silvicultural and grazing management and the linkage of unplanted areas as open space.

The overall pattern is a mosaic which is continually changing



ALTERED SURFACE PATTERN

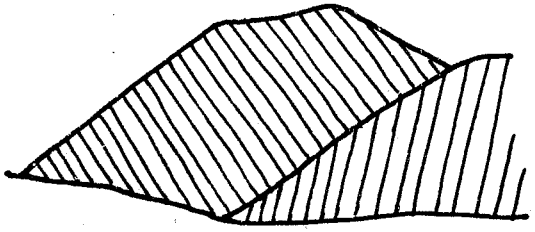
Visual implications will result from an alteration in surface pattern - colour/line/textures.

Colour: Related to vegetation type. Due to nearly complete devotion in New Zealand Agroforestry research for the species Pinus radiata, Woodstock is likely only to demonstrate this species in the "Forest-farm" project. Therefore there will be little variety in colour. The dark tone of Pinus radiata contrasts with that of pasture, especially if grass becomes rank and browned off due to hot dry conditions or poor grazing management. This will be most visible on north to north-west slopes. The contrast will have a visual impact.

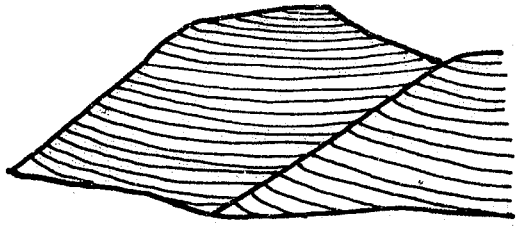
Line: Related to planting layout. The degree of visual impact of line depends on whether it follows along the contour (integrating with the basic landscape character), or lies across the contour (becoming incoherent with the basic landscape) therefore decreasing in visual quality.

Planting at Woodstock is done across the contour, up and down slope, as it is said planting is easier to supervise this way.

After planting, these rows are most prominant, however with increased thinning the rows become less tangible.

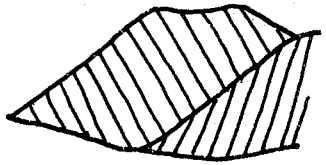


Planting across contour

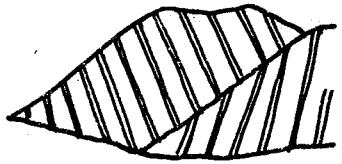


Planting along contour

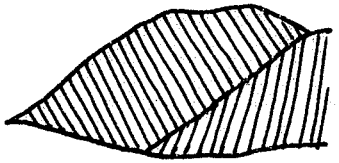
The greater the spacing between single and double rows the greater the incoherence with the basic landscape character, the lower the visual quality, and the greater the visual impact.



Widely spaced rows

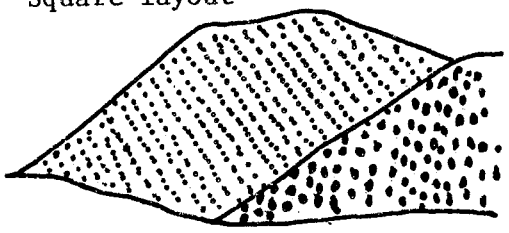


Widely spaced, double rows



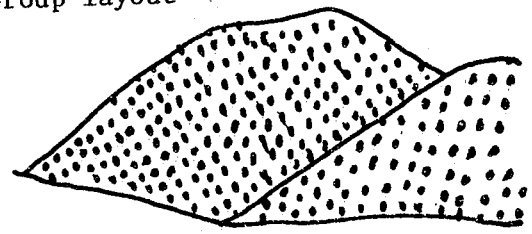
Closely spaced rows

Square layout



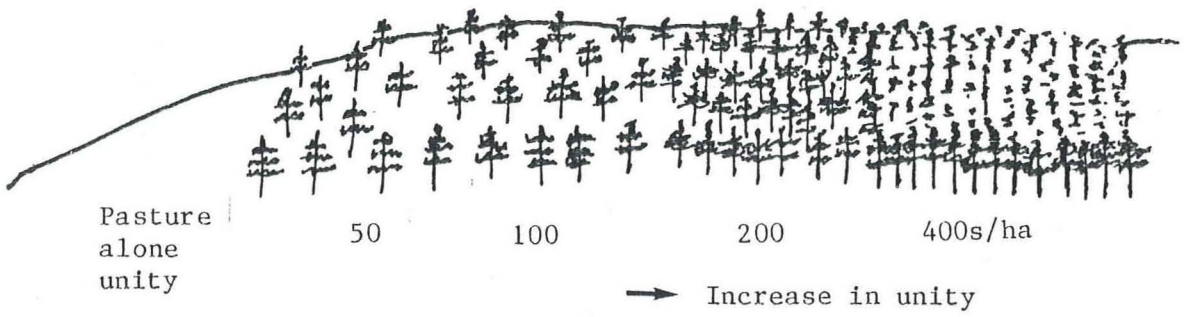
after thinning

Group layout



after thinning

Square planting and group planting will not have such prominant lines. This is especially so for the space layout after thinning.



Texture is related to spacing.
The greater the spacing between trees the more open and course the texture, and more "spottier" it becomes. The spottier the texture, the lower the degree of visual unity.

"Spottiness" decreases with age of the tree, and diminishes as the canopy closes. However, after each stage of pruning and thinning, the spottiness is increased.

"Spottiness" gives a diffuse surface pattern. Compared with the pastoral surface pattern, the basic landscape character becomes less coherent, the underlying dynamic processes - the landform, drainage and succession become less tangible. The more stems per ha the more intangible these become.

The greater the contrast in colour, the lower the unity and coherence of line and texture with the underlying landform, the greater the visual domination of the surface pattern. The scale of the landform becomes reduced, the contours become less distinctive, thus the overall landform becomes less dominant.

VISUALLY VULNERABLE ATTRIBUTES

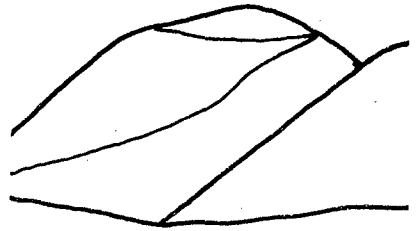
Edge: With phased development of the rotational silvicultural and grazing regimes from "block to" block, the "edge" becomes an important visual change needing careful treatment.

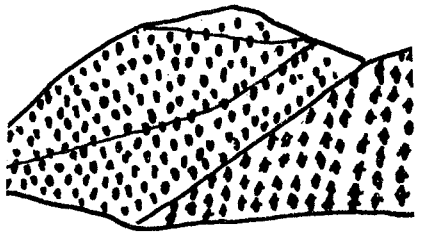
These edges are mainly determined by the fenceline. The paddock boundaries are chosen to fit the local topography. Because of steepness and risk of erosion, ridgelines are often the most suitable sites for fencelines. Therefore visually vulnerable "edges" often lie upon visually vulnerable ridgelines. The greater the contrast between "edges" the lower the degree of coherence with the ridgeline, the greater the visual impact.

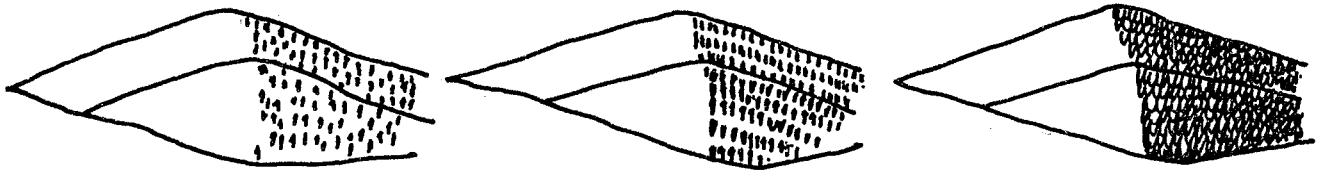
The open, diffuse pattern of low density planting of 100 stem/ha in square or group planting layout would give low contrast, and would be coherent with the ridgeline. Row planting, and higher density planting, would have greater visual impact, and would be unfavourable.

This would be especially obvious on the northern slopes where surface pattern is more conspicuous due to lighting effects.

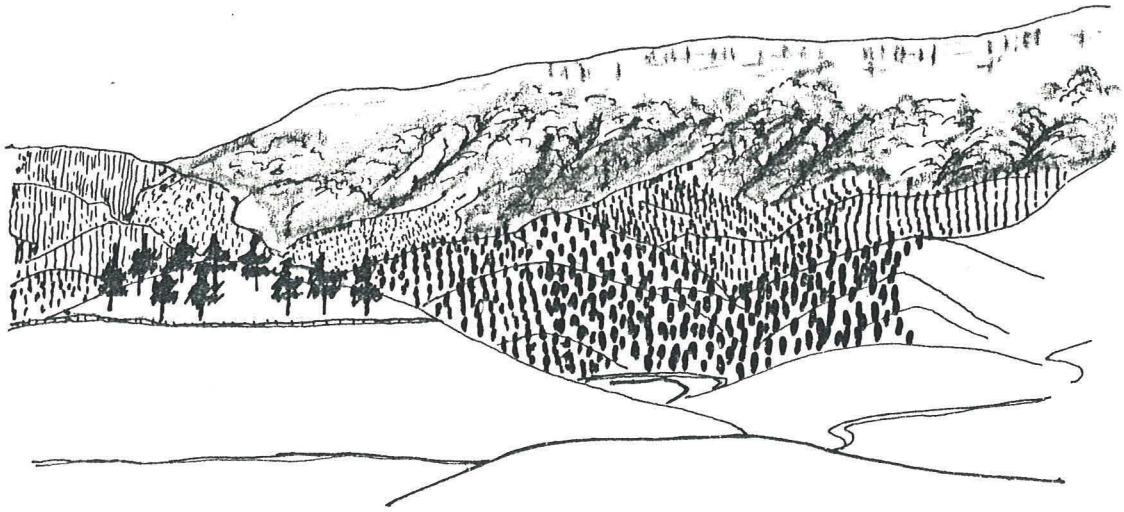
Roads: The diffuse open pattern would cause roading across slope to be less visually obvious, compared to the pastoral system. This would be especially so on southern slopes, which are less obvious due to shadowing effects.







Location: The higher altitudes of the range country are not programmed to be planted, but left as extensively grazed. Therefore the management of the Forest-farm will not affect the significant contour distinction, scale, or domination of the Maungaharuru Range, which is the backdrop to the broader Woodstock landscape. The "Big Country" character of Woodstock will therefore be retained.



In comparison the complex gullies, hillocks and knolls at the foot of the ranges, where the "Forest-farm" system is being developed, is smaller in scale.

A significant degree of reduction in the scale of the landform, will be due to the overall diffuse, mosaic, random pattern of the Forest-farm management. The basic landscape character, the underlying landform and its processes will become less obvious due to the domination of the surface pattern.

THE CHANGE IN LANDSCAPE CHARACTER

The development of the "Forest-farm" will alter the landuse - landform relationship due to the altered surface pattern, changing the visual image of the landform, its contours, and relative scale i.e. the basic landscape which is the primary source of visual character.

The diffuse and mosaic pattern, the contrast in colours, the prominance of line and "spottiness" of texture, causes the integrated tree and pasture to be a dominating surface cover compared with pastoralism. The "Forest-farm" surface pattern makes the land, its form, its contour and natural patterns (drainage, and succession), less tangible and coherent, its scale reduced. Overall the basic landscape becomes less of a feature.

The more dominant the surface pattern, the less the basic landscape features, the greater cultural impact on landscape character.

The more extensive the "Farm-forest" management, expressing visually a mosaic and varied pattern of colour/line/texture, the more cultural the landscape character.

CHANGE IN VISUAL QUALITY

The researched "Forest-farm" management options have opportunities for creating visual quality in the landscape by creating greater variety in the broad landscape, and a greater sense of mystery within.

However, there are real limitations for coherence in the landscape, in which the basic landscape becomes intangible. The landscape can lose its logic, in terms of form/scale/contour and natural process by the domination and incoherence of the surface pattern.

Variety and coherence are limited with the restriction of species. All sites with different environmental conditions will be all treated the same. Unique site ecology will be given the uniform recipe solutions. The logic of the best species suitable for the site and purpose is lost. All sites will become the same, a trend towards monotony and "placelessness".

2.2.3 SUMMARY OF VISUAL IMPLICATIONS

The alternative "Forest-farm" landuse option, Pinus radiata and the different recipes for layout, spacing, silvicultural and grazing management over time, and the overall rotational planting and open space plan, determines the altered surface pattern upon the landform.

This altered surface pattern, from pastoralism to forest-farming alters the fundamental relationship of the landuse with the underlying landform. The less coherent this surface pattern is with the landform, the lower the integration of the landuse with the basic landscape character, and the more cultural the landscape.

The significance of visual impact depends on the level of integration and how this relationship is expressed at visually vulnerable areas.

For Woodstock visual impact is most significant around the edge of the 25 ha block, i.e. the fenceline especially as it is often sited along the ridgeline. The visually strong regular patterns of FRI layout recipes, especially that of the widely-spaced double rows are especially vulnerable visually. The visual impact created would most likely be incompatible with the basic landscape character.

References:

LITTON R. Burton Jr
Visual Vulnerability of Forest Landscapes
Journal of Forestry
Vol 72, No 7, July 1974

LITTON R. Burton Jr
Aesthetic Dimensions of the Landscape
Ex J.V. Krutilla Natural Environments
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B3: OPPORTUNITY FOR DESIGN WITHIN THE AGROFORESTRY SYSTEM

3.1 DESIGN CRITERIA

To achieve a compatible relationship between management options, people's needs and the landscape, the basis of design must be based on these different but interrelated requirements.

Technical and Economic Criteria For The Forest-Farm Landscape

The integrated "Forest-farm" system is to be managed for optimum profitability by producing high quality timber, while at the same time, pasture utilisation is to be maximised.

The technical and economic criteria is to achieve the most effective integration of forest and farming; but not to compromise landuse practices; and to achieve efficient and competitive land utilisation.

Woodstock is managed as a commercial venture, however there is emphasis on new management techniques and the demonstration of the practice of Forest-farming (1982 Management Plan).

Technical and economic design criteria should also consider the requirements which Woodstock is demonstrating to* - the "small grower". Here the landscape is seen as an "Artifact". The alternative management options expressed offer technical and economic meaning: diversification in land utilisation, long term farm income, establishment of a family-based sustainable forest crop, and a means of getting accessible forestry on suitable land.

Ecological/Environmental Criteria

To ensure economic/technical success of the Forest-farm concept the system has to be ecologically/environmentally sound.

To ensure a healthy habitat for both man, animal and bird, domestic or wild, the land management needs to be harmonious with nature, working with her not against.

Social Criteria

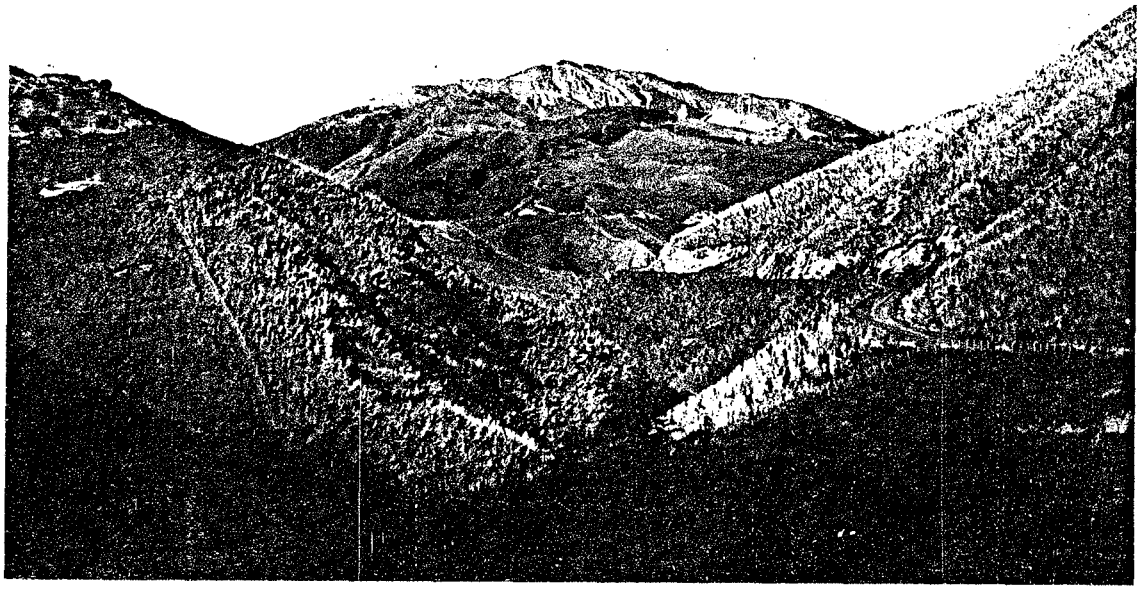
The demonstration Farm-forest concept offers the smaller grower a management option for commercial forestry at a small scale (possibly family-based).

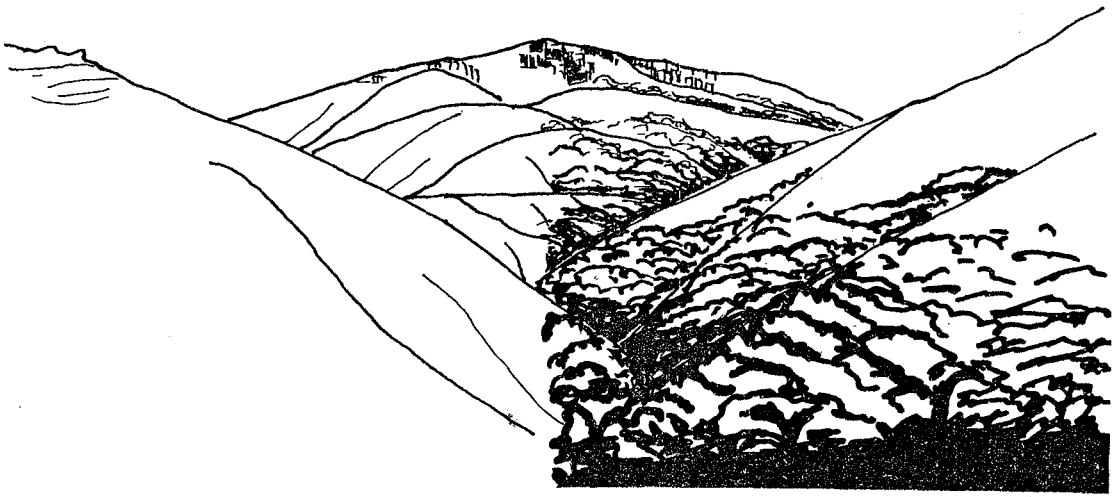
The management option therefore needs to fulfil the needs of the local rural community. To ensure owner-occupier control and site identity - their sense of "place" associated in the landscape.

"We need to get into think small and high value, into farm forestry that creates local opportunities, locally controlled.

And other farm forestry values other than timber values."

B. Treeby





Aesthetic Criteria

"The level of enjoyment people gain for a landscape reflects the quality of the landscape's relationships - the extent to which the patterns relate to each other and to the whole scene."

C. Anstey and S. Thompson

Criteria for Visual Quality:
The degree of visual quality of a developed Forest-farm system reflects its fundamental relationship with the land. For visual quality the landscape needs coherence, unity, variety and mystery.

Criteria for Integration:
Design sources for visual quality is from the understanding of natural patterns, and is an essential criteria for the harmonious integration of an alternative landuse. The integration design opportunities are to be found within the basic landscape character, the underlying landform and its processes.

The expectation of a natural landscape is usually diverse patterns within a unified, cohesive character.

DESIGN APPROACH

The design approach to Agroforestry should have a holistic approach to fit all the economic, environmental, social and aesthetic requirements of the "small grower", the community, and the site, in a production system, which is harmoniously integrated with the land.

The success of the system developed will depend on the site's capability and suitability and the compatibility of its different requirements, with the management option chosen.

CAPABILITY - technical feasibility

SUITABILITY - practical feasibility

COMPATABILITY - the ability to "fit" different uses/values required

Degree of compatibility

"is a method by which the nature of a place can be learned." ... "in its variety, it offers different resources. The place must be understood to be used and managed well. This is the ecological planning method."

McHarg

"Modern landscape design essentially rests on a knowledge and understanding of the working and balance of natural forces."

M.F. Downing

"Studies of intrinsic suitabilities for agriculture, forestry recreation and urbanisation reveal the relative values for each region and for the basin within each of the specified land uses. But we seek not to optimise for single, but for multiple, compatable land uses."

McHarg

3.2 DESIGN OPPORTUNITIES WITHIN THE AGROFORESTRY SYSTEM AND THE ALTERNATIVE MANAGEMENT OPTIONS

"Planning and design decisions are, or should be, influenced by site conditions, the nature of the soil or rocks, the presence or absence of vegetation, the drainage pattern and the topography, as well as the influence of artefacts, all play a part in arriving at a design solution."

M.F. Downing

Integration - character

... *"The landform, river systems, soils and vegetation are a response to natural forces. Their form must be reflected in the form of any alteration. Although the new cover may be exotic, the patterns need not be unnatural."*

Anstey and Thompson

SUBDIVISION AND ZONING

There is a narrow gross margin to which the Agroforestry is economically feasible, to compete with traditional pastoral or forestry sytems in Hawkes Bay.

Tim Aitken (Carter Holts)

Therefore it is unlikely that the area of any one farm would be totally suitable to Agroforestry. However, it is likely that within any one farm there would be a variation of site conditions which would be most suitable to different production systems, pasture, forestry or the combination of the two - Agroforestry.

Technical and economic limiations for suitability of land for forest-farming in Hawkes Bay depend on:

- Location/accessibility/slope restrictions for harvesting
- Altitude: above 700 m unfeasible, due to stunted growth
- Suitable site index/fertility: needed to grow high quality timber efficiently, but not too fast so deteriorate in quality, and not too productive so unable to complete with efficient traditional pastoralism

Therefore economic forest-farm system should therefore be developed as a response to the environmental conditions of a specific site, topography, soil, and the productivity of the land.

Every Hawkes Bay farm has its different environmental conditions which landuse responds to. The allocation of land for forest-farming needs to be flexible enough so it can respond to the different topography, altitude, aspect, micro-climate, soil type and productivity of the land; in technical and economic terms.

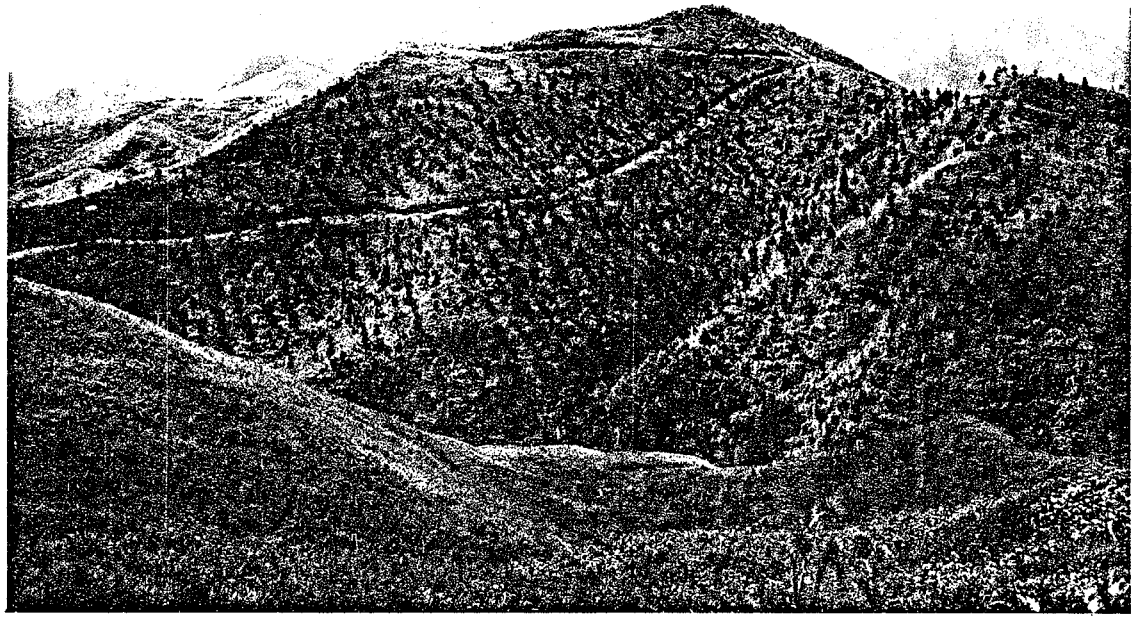
The Woodstock subdivision policy has been based on altitudes, location, and level of present development. The land which has been developed longest is zoned as the base farm.

The subdivision of the 910 ha for forest-farming was divided into 25 ha blocks on the basis of access for felling and stock control. Paddock boundaries are chosen to fit the topography, to ensure even stock grazing, with planting uniform throughout, from ridgetop to gully.

However, from observation the predicted uneven grazing between unplanted and planted areas within a block, is no real problem at Woodstock, especially in the case of wide tree spacing at 100 stems per ha.

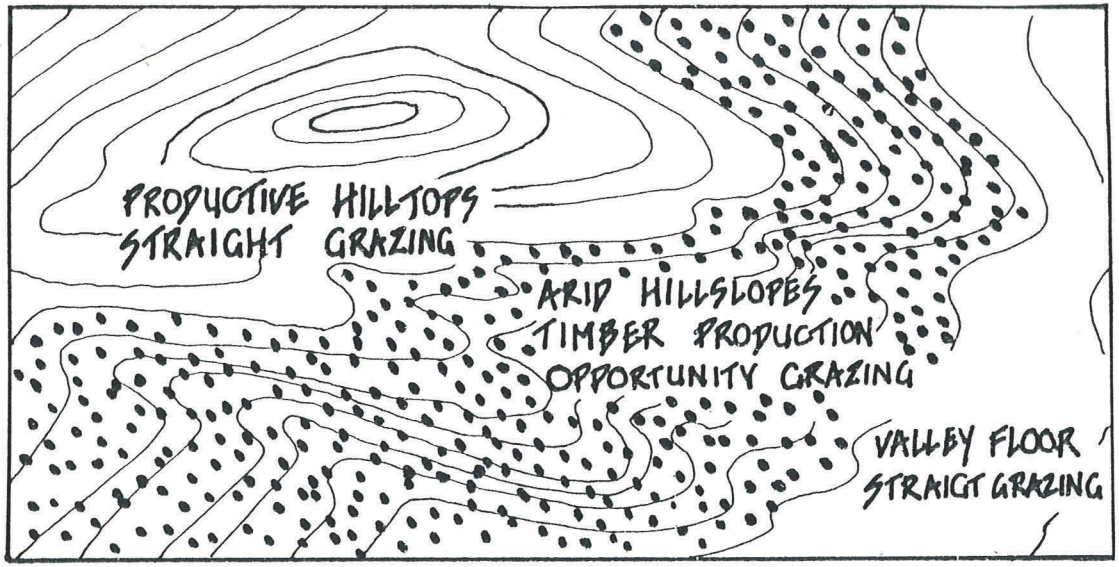
The area zoned for forest-farm development at Woodstock may be all suitable environmentally, and therefore economically. However it is the planning criteria used, which could be queried. No other farm will have the same conditions as Woodstock.

To optimise land utilisation, the criteria for allocating land for tree/pasture integration should be flexible and be based on land suitability - environmentally, technically and economically.



Woodstock planting from ridgeline to gully bottom

John Aitkens' property, Tuki Tuki Valley



John Aitken's property, Tuki Tuki Valley is an example of flexible landuse planning based on land suitability.

In this case the hill tops are most productive parts of the land and are left unplanted. The hillslopes, because of arid summer conditions experienced locally in this valley, are suitable for timber production and opportunity grazing. If uneven grazing does prove a problem at establishment stage, electric fences may prove useful.

The criteria is to have best landuse in terms of land suitability. This creates greater opportunities for the forest-farm system to integrate with the environment. Unsuitable, uneconomic areas - the tight steep gullies, steep slopes, high altitudes, exposed ridgelines, rock outcrops would not be planted. The farm forestry system would respond to environmental conditions, therefore the basic landscape character.

Steep slopes and gullies requiring soil and water conservation, suitable for forest-farming could be fenced off and native vegetation allowed to regenerate. These areas would act as wildlife corridors to the range country beyond.

Open space expressed as areas not suitable for planting, or for stock access, will create a greater sense of site identity - reducing the monotony by logically breaking up the area planted, reducing its overall scale.

The criteria of best land utilisation based on land suitability, which is compatible with natural patterns, will ensure a coherent relationship between landuse and landform.
A coherent production landscape that makes sense - economically and environmentally.

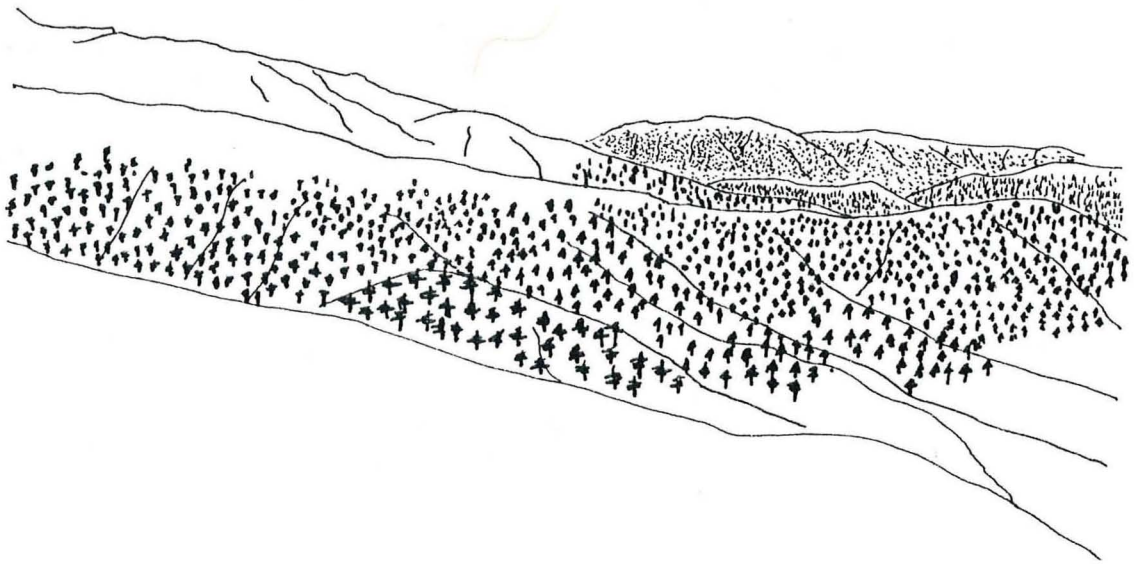
Ridgelines/Fencelines: Exposed ridgelines are unfavourable for quality tree growth due to the shallow soils and the stress of wind. Therefore it would make economic sense not to plant the major ridges at Woodstock.

It is easier to push sheep uphill and along ridge fencelines. Therefore open ridges would ease stock movement.

Fire always travels rapidly uphill. For this reason forestry traditionally has fire brakes on ridgelines. Therefore to leave ridges unplanted and well grazed makes good sense.

Aesthetically the ridgelines are visually vulnerable areas especially if they become boundaries between management regimes as well. Therefore to leave these areas unplanted would lower the possibility of incompatible visual implications, as a result of contrasting edges of incoherent tree/pasture surface pattern upon the landform.

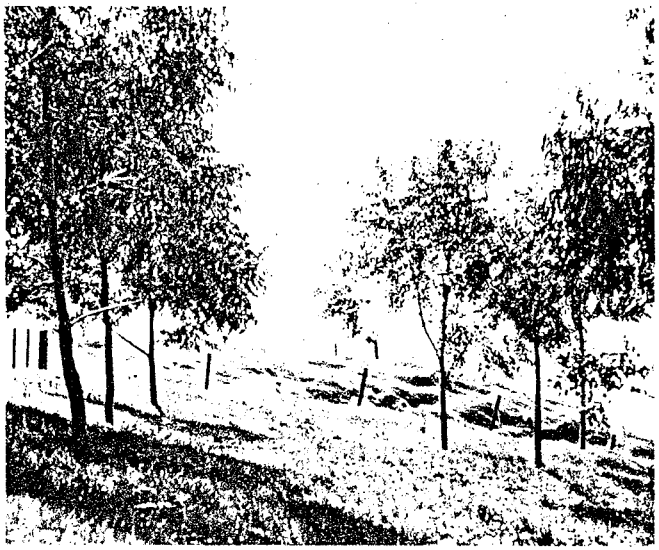
Under the management plan, planting is to be 3.5 m away from fencelines. If this distance is to be varied, the visual implact of edge will be reduced.



3.2.2 SPECIES

The FRI scientists have given almost complete devotion to Pinus radiata in Agroforestry research. It seems the more they know about Pinus radiata the less they know about other species and their potential. Pinus radiata does have its downfalls in the Agroforestry system. There is a large amount of slash, needles causing abortions to breeding cows, and a fast growing, dense canopy significantly reducing the duration of pasture production. Alot of research has been done to alleviate these problems. This has not been the case for other species.

Overseas there are many species used for Agroforestry. At present different short rotation species which look feasible for Agroforestry are apically dominant, Eucalyptus, popular, Acacia and willow.



Eucalyptus saligna trail
Tikitere 1974
(does not get a mention
in 1983 Tikitere Handbook)

Eucalyptus

Experience in Australia (Nan Oates) has found in suitable locations, fast growing Eucalyptus are particularly suited to Agroforestry having a number of advantages over pines. Being largely self-pruning, they grow tall and straight and reach pulpwood harvesting age around 15 years and sawlog age from 25 -40 years. Slash, needles and dense canopy are not problems.

However, Eucalyptus has very strict site requirements such as Eucalyptus regnans "needing deep rich and well drained soils, at least 1,000 mm a year and an altitude ranging from 300 to 900 m. These have been used as lambing shelters - planted at 5 m intervals. In steep hill country with a harsh winter climate these trees provide a well sheltered haven and in time will be very valuable timber."

Species of Eucalyptus suitable for Hawkes Bay and other East Coast districts are given by Neil Barr N.Z. Tree Grower, August 1980.

Two examples of species worth planting are "E. Obliqua" - a strong durable timber especially suited to Hawkes Bay, hillside sites, climatically and soil wise; and "E. Muellerana" - a valuable stringybark tree, which is a fast growing hillside species suited to Hawkes Bay.

Populars

Populars used in Italy as Agroforestry systems on the Po Valley, with 3 - 4 m spacings with crops for the first 5 years and harvested at 10 years. Populars in new Zealand would have 10 - 15 year rotation depending on end use of timber. Populars and willows have long been used for erosion control on hill farms, as they can be established readily as large 3 m long poles in the presence of grazing animals. (A.G. Wilkinson, 1980). If pruned at least to 4 m these fast growing deciduous species provide ample shade in summer and sun in winter. So especially suitable where stock suffer from heat stress.

As a rotation tree which can be changed at year 5 or 6 from cropping to grazing these trees have high Agroforestry potential. The populars can be pruned to produce quality timber and prunings used as stock feed.

Long Term Species

Both short, intermediate and long term species should be recognised as possibilites. Research bias for the softwood of Pinus radiata, has been directed to satisfy the short term economic returns. However when looking at the stated long-term world shortage of hardwoods, it would surely be wise, with the high costs of land preparation and silviculture, for the small grower to contemplate higher quality trees, or both. If enough small growers became interested, co-operatives could be set up for marketing.

This wider approach to species would mean the economic, ecological, social and aesthetic needs of the land manager and the community, would be more likely to be fulfilled.

The costs of land preparation, silvicultural management and harvesting are important considerations for the land manager. The small scale of the forest-farm operation for which needs to compete as a feasible landuse, heightens the need to produce high quality timber. Hardwoods (such as Oaks, Ashes, or New Zealand Natives, Totora or Rimu) have value timbers managed on a sustainable basis could be attractive produce for the "small grower". However there needs to be encouragement for the "small grower" to start this tradition due to their long rotation period.

"The New Zealand Farm Forestry Association should be pushing for greater use of hardwoods.

The world's hardwood resource is being rapidly overcut.

These other species can be used on a more sound ecological basis, and economically can be viable in much smaller compartments."

B. Treeby

"Where there is variation of soil and topography, the best results come from good forestry practice in changing the species to suit the situation."

Silvia Crowe

"In an exotic forest the aim is to satisfy the broadest possible spectrum of human and ecological needs by choosing species which have a diverse range of functions."

Anstey and Thompson

Design therefore should look for the opportunity to incorporate both short and long term rotation timber crops.

Environmentally Pinus radiata is suited to most Hawkes Bay environments, however specific small scale sites at lower altitudes are often better suited to a site-selective species. The timber tree chosen, should be the most capable, suitable and compatible species for the particular site.

Farmers are aware of aesthetics! Due to large scale and widespread use of Pinus radiata in New Zealand, it tends to be thought as "boring trees". The use of other species gives variety to the landscape, a sense of site identity, as well as diversity in wildlife habitats.

There needs to be a broader approach in Agroforestry research, with more emphasis on species other than Pinus radiata. To explore the capability, suitability and compatibility of different species, their different values and purposes, which could make them attractive to the small grower and therefore possibilities for the Agroforestry sytsem.

3.2.3 LAYOUT AND SPACING

The FRI scientists have put out strict recipes for layouts, spacings, and silvicultural management for "Forest-farming"

The layout patterns are rigid and usually geometric; squares or rows with regular spacings between. This is done as a means to optimise on grass production and reduce areas of slash, and the competition between trees. However, these management options are inflexible when considering environmental conditions such as the broken hill country of Hawkes Bay. This is especially so with row planting. Group planting does offer some inflexibility as a group of trees could be planted on the basis of site suitabability, with spacing only as a second consideration. Group spacing also has the benefits of easy access and plenty of light for good grazing.

Thinning is traditionally done on the criteria of spacing.

However Patrick Milne, FRI, Rangiora states that only "good trees" should be retained in Agroforestry.

It is interesting to compare the FRI forest-farming recipes with the more flexible silvicultural recipes of the farms in the Tuki Tuki valley. The planting is still initially planted in regular rows but becomes flexible to environmental conditions at the site level. Thinning is based on straightness and potential of tree quality not spacing. This is done as soon as defects can be recognised. At year four this gives a sparse low-cost forest which averages around 150 stems/ha.

This suggests silvicultural management for the Forest-farm system could be more flexible. Geometric regularity, for least competition could not have to be criteria for spacing. Thinning could be done, so only best trees are retained, which will average out to a low density, based on suitability and compatibility.

Photos:
Top:
Double rows 100 stems/ha, Tikitere
Source: FRI SS 26614

Bottom:
Flexible layout/spacing, 150 stems/ha
John Aitkens' property
Tuki Tuki Valley

"Our productive rural landscapes can be a beautiful response to natural patterns. They need not be comprised of geometric, formal unrelated patterns."

Diane Lucas

planting ... on hill land

"should be related to the contours, accentuating, and giving rhythm to the land form."

Silvia Crowe

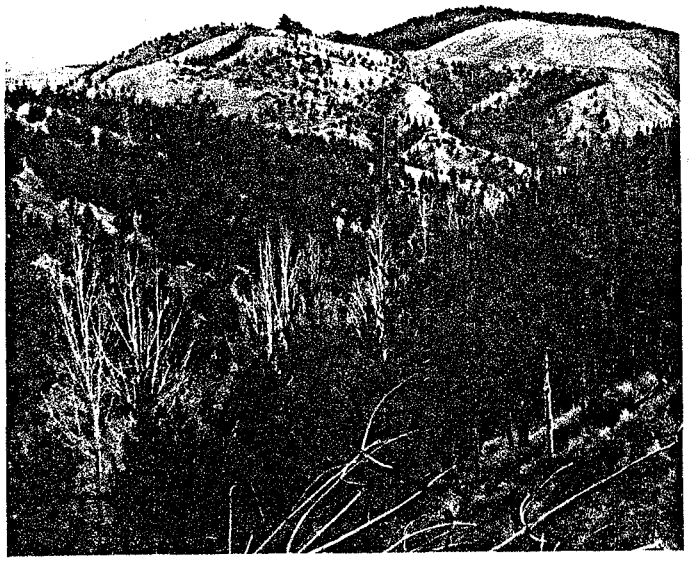
Landscape Architects, D. Lucas and I. Stäger recommend the Quincunx pattern to be used as a basis for planting layout. They state that "Widely spaced trees are beautiful when combined with pasture if they are grouped. The forest-farming concept is very useful where trees are carefully sited in an informal arrangement which meets the needs of both industries."

Quincunx pattern used as a basis for planting layout

Flexibility offers greater opportunity to integrate the tree/pasture surface pattern to the basic landscape character; to become more coherent with natural vegetation, topography and drainage patterns.

Planting patterns which are in sympathy with the contour, instead of lying across it, certainly is an opportunity for better landscape integration.

To have a flexible integrated forest-farming layout, and management that responds coherently to the topography, environmental conditions and to the lands productive suitability, gives a greater opportunity to have a harmonious landscape - landform relationship.



3.2.4 LIVESTOCK

Most of the research done by the FRI scientists for Agroforestry has been devoted to cattle and sheep.

Some farmers in Hawkes Bay are diversifying with breeding deer and goats.

Again research could have a more broader, radical approach, so to explore the different options which may be attractive to the "small grower". As a demonstration forest-farm Woodstock should go a step further in the investigation and demonstration of livestock options.

Grassy openings within the forest are natural habitats for deer. Hinds and fawns grazing under established timber trees is much more natural to deer than out in the open paddock without a tree in sight.

Aesthetically animals, especially deer lurking under trees, heighten the mystery of the semi-enclosed forest, giving an element of surprise.

Such management options within the Agroforestry system have values for future activities such as farm-parks and tourism.

"We (NZFFA) have done quite a bit of shelter, multiple use, etc., (wood and shelter).

We could do more on fodder tree and shrub crops per drought feed, browse for deer and goats."

B. Treeby

3.2.5 ACCESS

Appropriate roads are necessary through the forest-farm so to give access to all blocks. For easy harvesting the roads are best located above the planted area for hauling. Forestry roads need to have a gentle gradient and to be of good standard.

Opportunity for integrating the road to a hillslope: (1) is to follow the countour as much as possible

(2) to have the diffuse open surface pattern of integrated trees and pasture directly above and below to the bottom of the slope.

Photos:
Top:

OKUKU - integrated trees and pasture directly above the road and below to the bottom of slope

Bottom:

However if the planting does not continue to the slope bottom, its relationship to the landform and natural patterns lacks coherence.

The sequential movement through the semi-enclosed forest has interest and a sense of mystery because of its intangibleness.

Mystery is a source of visual quality. The more flexible, irregular silvicultural regimes, the greater the opportunity for interesting sequential movement. The opening and closing of varied spaces within forest-farm and the intangibleness of the tree/pasture pattern at ground level, certainly offers a setting of recreational and aesthetic value.

Square layout, after thinning, Tikitere
Source: FRI C/S24477

Widely spaced double rows, thinned 50 stems/ha Tikitere
Source: FRI SS24466

SUMMARY

The design approach should aim to fit all the different economic, environmental, social and aesthetic requirements of the "small grower", the community, and the site, in a productive system which is harmoniously integrated with the land.

The researched Agroforestry recipes, available for demonstration and for future implementation by the region's "small grower", need to be more flexible and diverse to fit the design criteria above.

Agroforestry demonstrated at Woodstock would need to then address the following design opportunities:

1. To plan for optimum land utilisation, to be achieved by a planting strategy based on landuse capability and suitability on a particular site.

2. To plan for optimum compatability in layout, species and silvicultural management, so to ensure harmonious integration between landuse and basic landscape, and that a multi-value, multi-benefit system is achieved.

Planting layout needs to be flexible so to be sympathetic to natural patterns and landform, with avoidence of strong geometric, regular patterns e.g. widely spaced rows. Group and square layouts, by being more flexible to site conditions and which follow the contour are more compatible to the basic landscape. Thinning should be based on timber potential and site conditions, rather than regular spacing.

Use of other species of timber trees and livestock at the small scale e.g. Eucalyptus and deer, give ecological and visual diversity, site identity, in both the short and long term.

There is no set Agroforestry recipe that will solve the requirements of every Hawkes Bay hill country farm. Every farm has different environmental characteristics, every farmer has a different set of objectives, requirements and values.

However, the design solution based on:
- flexible and diverse Agroforestry recipes
- a holistic approach, which aims for compatibility and integration
- and the different characteristics and values of the site

has greater opportunity for achieving a multi-value system, with visual quality, enhancing local character, and which creates a coherent, harmoniously integrated production landscape.

Sensitive Agroforestry design, expressed by the rural landscape, will give future opportunity for farm-parks, tourism and recreation; creating future economic, environmental, social, and aesthetic benefits for many people.

"SMALL GROWER" (and community)
objectives, requirements, values

RECOMMENDED BASIS FOR AGROFORESTRY DESIGN

INTEGRATION → CAPABILITY →
→ SUITABILITY
→ CAPABILITY

BASIC LANDSCAPE CHARACTER
land/form/scale/contour
Natural drainage vegetation patterns
Visually vulnerable attributes

DESIGN OPPORTUNITIES within Agroforestry system
Alternative Management options
- species - trees
- livestock
- layouts
- silvicultural/grazing regimes
- subdivision and zoning of land

→ DESIGN SOLUTION
Multi-use/multi-value system
- visual quality
- local character
- coherent, harmoniously integrated production landscape

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Conclusion

CONCLUSION

The evolution of the "small grower" and the growing interest of Agroforestry, as an alternative landuse for Hawkes Bay hill country is a result of political, economic, environmental and social motivations and pressures, from both the farming and forestry sectors.

The acceptance of Agroforestry will encourage afforestation patterns in Hawkes Bay to change from large scale, back country forestry, to small scale, intensively managed forestry, on better pastoral land closer to urban areas. Such future development will have economic, environmental, social, and aesthetic implications which will be expressed by the visual landscape, a resource in its own right. These implications and their corresponding values is the concern of the Landscape Architect.

The development of Agroforestry in Hawkes Bay could go ahead without proper consideration for these values, with its execution governed by economic and technical considerations.

Woodstock is to be developed as a commercial venture, governed by economic and technical considerations. It wil demonstrate the management, techniques, and practices of Forest-farming, suited to Hawkes Bay which will maximise profitability and production.

The visual impact is most obvious along ridges, fencelines, especially at higher altitudes.

Uniform species, in a diffuse mosaic pattern, and widespread areas, of different environmental conditions or social significance, offer little opportunity for ecological or visual diversity, or social identity i.e. sense of "Place".

No two Hawkes Bay hill country farms are the same. A farm will have a range of areas, with different environmental conditions and productivity, and a manager with his own set of objectives and values.

Agroforestry research therefore needs to have a wider approach, with more flexible layouts, spacings and management, and a diversity of species, so the needs of the "small grower" and the multiple values of the site, are addressed.

To have not only a productive and economically efficient system, but a system which has best land utilisation given its environmental conditions, ecoligical stability, sustainable family-based forestry with both short and long term crops, local character, a sense of "Place" and a favourable aesthetic expression.

Some farmers are aware of the environmental, ecological, social, and aesthetic values of Agroforestry. Others would be aware, if the values were to be demonstrated.

The contribution of the Landscape Architect is to use the opportunities within the Agroforestry system in a holistic approach, to fit the different requirements of the small grower and the site, in a multi-use/multi-value production system, which is to be harmoniously integrated with the land.

The rugged pastoral hill country, programmed for Forest-farm development at Woodstock, is characteristic to Hawkes Bay. These hills will demonstrate the researched Agroforestry recipes; the planting layouts and management, within 25 ha blocks.

Visual implications result from the change from pastoralism to Forest-farming because of a change in the fundamental relationship between landuse and landform, expressed by the surface cover. The Forest-farm surface cover compares with pastoralism, as a mosaic and diffuse pattern. It continually changes through time and space, as a response to intensive, phased and varied silvicultural and grazing management.

Prediction and evaluation of visual implications, the changed visual character and quality, showed a distinctive gap between the researched Agroforestry options available for Woodstock and landscape objectives.

- There were limitations for harmonious integration between landuse and landform, to enhance local character, and to produce a logical coherent production landscape.

- There were limitations in fulfilling different, economic, ecological, social and aesthetic requirements of the "small grower" and the community as a whole.

The researched Forest-farm recipes have inflexible geometric and regular layouts and spacings. These have limitations for landscape integration and enhancing local character.
The underlying basic landscape, (landform/contour/scale) and its natural patterns become intangible and incoherent, due to the illogical and unsympathetic lines and the regular, geometric patterns of layouts and spacings, especially those of widely-spaced single or double rows.

Dr R.H. Best, land use planner, Wye College says "Without skilful and enlightened planning it is inconceivable that the quality of the countryside and the harmonious integration of landuses can not be maintained or improved for future generations. Above all, it cannot be stressed too often the path to visual hell is frequently paved with sound economic intentions.

"Best 1968"

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